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Harold D. Melton Student Center

**This booklet includes the abstracts of the
presentations.**

**The abstracts are ordered by the first name of
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Title: First report of the resistance breaking (RB) strains of tomato spotted wilt virus (TSWV) infecting tomatoes with the Sw-5b resistance gene in Alabama

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Mentor: Kathleen Martin

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: In 2023, a tomato plant with symptoms of tomato spotted wilt virus (TSWV), necrotic spots on older leaves, concentric rings, stunting, and progressive wilting, was submitted from Marengo County, Alabama, to the Vector Entomology Laboratory for analysis. In 2024, three additional symptomatic samples arrived from the Chandler Mountain area in northeast Alabama. Leaf tissues from 2023-24 were processed for Sanger sequencing of the TSWV NSm gene. The 2023 NSm sequences (four colonies from one sample) lacked resistance-breaking (RB) mutations, whereas the 2024 sequences (five colonies from three samples) carried V49A, C118Y, and V141I. The C118Y substitution is associated with Sw-5b resistance breaking in Spain and the USA. In 2025, growers in the same region reported a severe TSWV outbreak. To determine whether TSWV-RB with C118Y was circulating and to test the Sw-5b RB phenotype under greenhouse conditions, we collected 10 field samples with different resistance backgrounds from three farms (Farms I–III). Seedlings of Sw-5b-resistant ‘Mountain Merit’ and susceptible ‘Beefsteak’ (25 seedlings per variety) were mechanically inoculated at 17 days after emergence with TSWV-infected leaf tissue from Farm III. At 13 days post-inoculation, both cultivars showed typical TSWV symptoms, and infection was confirmed by ELISA; healthy controls were negative. NSm was sequenced from 2025 field and greenhouse plants, yielding 20 sequences: 12 from field samples (including a pooled Farm III inoculum) and eight from mechanically inoculated plants (four colonies per variety). The 2024 mutations persisted in 2025, and a new I130V substitution appeared in 55% of sequences (11/20), indicating ongoing evolution of RB strains in Alabama. Alabama’s 2024–25 NSm sequences also shared multiple mutations with RB strains reported from Texas, suggesting both local evolution and regionally shared lineages. Phylogenetic analysis grouped Alabama’s 2023 tomato isolates, which lacked C118Y and other RB-associated mutations, within Sub-clade 6.3 alongside peanut isolates, suggesting RB variants were likely absent from tomato in AL that year, whereas 2024-25 tomato isolates formed six host-associated sub-clades within Sub-clade 6.7 together with single isolates from North Carolina and Georgia, consistent with largely local diversification of RB-associated lineages. These genomic and phylogenetic data provide the first evidence of TSWV-RB strains overcoming Sw-5b-mediated resistance in tomato in Alabama, making Alabama the third southeast state in the United States to document a severe outbreak of TSWV-RB. This underscores an urgent need for more durable TSWV management and resistance strategies.

Title: FoMO, social media, and sleep: Untangling a subtle but significant pathway

Primary Author: Abigail Brewer

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Mentor: Sarah Lust

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Nighttime sleep is increasingly disrupted by immersive social media use. The rapid growth of online platforms has amplified the Fear of Missing Out (FoMO), an anxiety-related construct. FoMO has been linked to poorer sleep hygiene and persistent checking behavior. College students are vulnerable given their high FoMO, so this study examined whether coping-like social media behaviors mediate the relationship between FoMO and sleep outcomes among college students. Four cohorts (2020-2024) of Auburn University undergraduates (N = 1,993) completed a survey in Qualtrics about health and well-being. Measures included: FoMO (mean, 1–5), daily social media time (hours/day), average sleep (hours/day), sleep satisfaction (1 = extremely satisfied; 5 = not at all satisfied) and the PHQ-4 depression/anxiety. We tested simple mediations (PROCESS Model 4; 5,000 bootstraps) with FoMO as X, social media time as M, and sleep outcomes as Y. FoMO predicted greater online use ($b \approx 0.53$ hr/day per FoMO, $p < .001$). Greater online use related to shorter sleep ($b = -0.07$ hr per additional hour/day, $p = .0002$), yielding a significant indirect effect from FoMO to average sleep ($b = -0.037$ hr, 95% CI $[-0.062, -0.015]$) while the direct FoMO-sleep path was nonsignificant ($p = .41$), indicating indirect-only mediation. For sleep satisfaction, more time online was associated with lower satisfaction ($b = +0.039$, $p = .0002$), and both the indirect ($b = +0.021$, 95% CI $[0.010, 0.035]$) and direct FoMO effects ($b = +0.146$, $p < .001$) were significant, indicating partial mediation. In parallel analyses with mental health outcomes, FoMO showed strong direct links to depression ($b = .43$, $p < .001$) and anxiety ($b = .54$, $p < .001$), but time online did not mediate those associations. Overall, students higher in FoMO spend more time on social media, which is linked with slightly less sleep and lower satisfaction. Promoting screen time awareness may support campus wellness and sleep hygiene among college students.

Title: Site specificity of pine ecosystems

Primary Author: Abigail Garner

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Mentor: Emily Knox

Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: Alabama is one of the most biodiverse landscapes in the continental United States, with a long and complex history of timber production. Nearly 70% of Alabama is forest, with 28% designated for industrial use. These industrial forests are prominent economic and ecological resources, deeply ingrained in the culture of the South, and shape the understanding and use of landscapes in the state. The emphasis on timber production in forests has blurred the line between timber plantations and ecologically robust forests, oversimplifying forests into mere fiber production systems and reducing other values such as biodiversity and ecological stability. This research will focus on developing a more nuanced understanding of these sociocultural landscapes to better frame their complexities and ecological and spatial value. Through field-based research and the exploration of representational techniques, this project documents the forest as a complex system with value beyond intensive extraction, focusing on aspects of the forest system, including human interactions, natural disturbances, seasonal changes, and management regimes. The project produced a collection of artifacts, including digital drawings, models, photographs, maps, and other techniques, adding much-needed nuance to the conversation around the forest and endeavor to represent the landscape holistically as a complex and dynamic system. These representations are collated to create an easily understandable collection that outlines key features of the forest and its processes, to be shared across disciplines and to help further discussions surrounding the timber industry and forests. Further, this demonstrates landscape architecture's ability to speak across disciplines and advocate for the landscape through various techniques.

Title: Integrating pharmacogenomics into the treatment of neuronal malignancies

Primary Author: Abigail Knight

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Mentor: Muralikrishnan Dhanasekaran

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Precision medicine has become a central focus in contemporary biomedical research, with pharmacogenomics playing an increasingly vital role in personalizing drug selection and dosing based on individual genetic profiles. In the context of central nervous system (CNS) tumors, pharmacogenomic approaches are particularly relevant, as these malignancies often present with severe symptoms and reduced life expectancy. Tumor size, location, and histological type significantly influence therapeutic strategies and prognosis, necessitating tailored treatment plans. Current treatment modalities for neuronal malignancies include surgery, radiation, chemotherapy, immunotherapy, and emerging nanotechnology-based approaches, each with distinct pharmacokinetic and pharmacodynamic considerations. Optimizing drug delivery while minimizing neurotoxicity and long-term cognitive deficits remains a critical challenge. Genetic factors, including age, race, radiation exposure, and inherited syndromes, further contribute to variability in treatment response and outcomes. This narrative literature review examines existing research on pharmacogenomics as applied to CNS tumors, with an emphasis on drug response, adverse effects, and individualized therapeutic strategies. Evidence was found by researching papers about pharmacogenomics, CNS tumors, and treatment options that can be used to personalize patient treatment. Most of these sources are recent, because precision medicine is a currently active and evolving topic in healthcare. Although the current body of literature is limited, available evidence suggests that pharmacogenomic-guided interventions hold significant promise for improving prevention, diagnosis, treatment efficacy, and prognosis in patients with neuronal malignancies.

Title: Exploring a novel narrative analysis method to detect language impairment in children with speech sound disorder

Primary Author: Abigail McBournie

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Mentor: Anna Ehrhorn

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Speech sound disorder (SSD) is inaccurate production of speech sounds and commonly co-occurs with language impairment (LI). Research suggests that narrative analysis focused on elements of micro and macrostructure significantly detects LI, but speech production errors may bias these elements. Evidence inconsistently agrees upon which elements identify LI in SSD and lacks methods to improve diagnostic accuracy, resulting in children with SSD and undetected LI being dismissed prematurely. The present study explores a narrative analysis method to improve LI detection in SSD, leading to earlier language intervention. The developed method captures micro and macrostructure elements of narratives through 2 stages. Stage 1 involves transcription of each narrative within Phon software, providing automatic analysis of some elements. Stage 2 requires coding of elements within a developed criterion-referenced protocol. Four microstructure elements are coded and calculated: percent of communication-units (C-units) with linguistic errors, average number of different words used, average number of mazes in a C-unit, and average C-unit length. Four macrostructure elements are coded and analyzed: percent of story structure elements included, average number and type of each story episode, presence of story climax element, and percent of complete cohesive ties. All elements are scored using a 5-point scale to determine whether expected norms are met and combined into a composite score. Piloting of this method will occur on existing narrative samples from 6–8-year-olds with or without SSD and varied language abilities. Descriptive results will provide preliminary utility that can be refined for future clinical validation and improve diagnostic accuracy to initiate language intervention. Improvement of language diagnostic accuracy in SSD will ensure earlier and accurate intervention for all deficits minimizing impact on academics while mitigating later service and financial resources.

Title: Cell Migration using Traction Force Microscopy

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Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: As the fundamental units of living organisms, cells depend on finely tuned physical and biochemical environments to carry out essential biological functions. Cells embody directed cell migration, which is a critical process underlying a wide range of activities such as wound healing, tissue regeneration, immune surveillance and cancer metastasis. During migration, cells probe their microenvironment, generate and regulate mechanical forces needed to enable optimal motility. Increasing evidence suggests that cells migrate optimally within specific ranges of physical conditions, and deviations from these conditions can significantly alter migratory behavior. One important but underexplored physical cue mediating cell migration is fluid pressure, which reportedly increases during solid tumor progression, dynamically changing biological microenvironments. To address this problem, we employ traction force microscopy, a powerful approach to elucidate cell–substrate interactions and the forces driving motility. In traction force microscopy, fluorescently labeled microbeads are embedded within a hydrogel to help quantify the magnitude of forces exerted by migrating cancer cells. Cell migration on polyacrylamide-based hydrogels was monitored by time-lapse fluorescence microscopy of H2B-mCherry–labelled HT-1080 cells. As the cells migrated, they deformed the underlying matrix, displacing the embedded fluorescent beads. By tracking bead displacement relative to the red fluorescence of the cells over time, we quantified the traction forces generated during migration by finding the displacement of the beads resulting from cell movement and predicting the required traction force to result in that displacement. Multiple trials would be performed with different exposures to hydrostatic pressure to see the effects on the cells' traction force. The application of this technique would help us understand how this physical cue regulates directed cancer cell migration, providing insights that may inform anti-metastatic therapies.

Title: Vertical center-of-mass velocity on ball velocity and elbow valgus torque in tall-and-fall and drop-and-drive Division I pitchers

Primary Author: Adam Hoechstetter

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Mentor: Gretchen Oliver

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College: College of Education

Abstract: Baseball pitching stride styles are commonly categorized as tall-and-fall (TF) or drop-and-drive (DD). The TF pitching stride is classified as staying tall and dropping the vertical center-of-mass (vCOM) closer to the stride foot contact (SFC), and a DD pitching stride is classified as sinking into the driving leg after peak knee height (PKH). While both stride styles have been investigated in relation to performance and injury risk, vCOM velocity has yet to be explored. The purpose of this study was to examine the relationship between vCOM velocity and ball velocity, as well as elbow valgus torque (EVT), for TF and DD pitchers. 252 Division I pitchers were included (DD: $n=174$, $1.89\pm.06\text{m}$, $91.97\pm10.4\text{kg}$; TF: $n=78$, $1.89\pm.07\text{m}$, $93.29\pm10.0\text{kg}$). In-game kinematic data were collected (300Hz) using an eight-camera markerless motion capture system and processed using KinaTrax software. vCOM data were collected during the stride phase between PKH and SFC. Pitchers were classified as TF or DD based on linear trajectories of vCOM position, with positive deviation signifying TF and negative deviation signifying DD. Fastballs within each pitcher's middle 80% of ball velocities were included. Each pitcher's vCOM velocity was interpolated to 101 data points from PKH to SFC and was averaged per pitcher. Statistical parametric mapping regressions were performed for both TF and DD groups to determine the association of vCOM velocity with both ball velocity and EVT ($\alpha=.05$). While EVT did not have a significant association with vCOM velocity, increased ball velocity was associated with greater downward vCOM velocity in TF pitchers from 39.4-68.9% of the stride phase ($p<.001$, $R^2=.021$). These findings suggest that downward vCOM velocity for TF pitchers influences ball velocity, whereas vCOM velocity for DD pitchers is not associated with velocity or EVT. Coaches and sports scientists should monitor TF pitchers' vCOM velocity to improve performance by increasing ball velocity.

Title: Recycling polymer-Lunar regolith composites for sustainable lunar habitations

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Mentor: Russell Mailen

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College: Samuel Ginn College of Engineering

Abstract: Sustainable human presence on the Moon requires efficient use of in-situ resources to construct infrastructure such as habitats, radiation shielding, and launch pads. Polymer–regolith composites produced through additive manufacturing (AM) offer a promising solution by combining polymer performance with abundant lunar material. While prior studies have examined the fabrication and mechanical behavior of polymer–lunar regolith composites, the recyclability of these materials—a key component for enabling circular and sustainable lunar construction systems—remains underexplored. This study investigates a recycling process for polylactic acid (PLA)–lunar regolith composites, separating and recovering the polymer component for reuse in AM. Fabricated composite specimens are immersed in ethyl acetate, a solvent selected for its effective dissolution of PLA and relatively low health risk. The resulting solution is filtered to remove regolith particles, and the PLA is subsequently recovered through phase separation using deionized water. The recycled polymer is characterized using thermogravimetric analysis, dynamic mechanical analysis, differential scanning calorimetry, and tensile testing to quantify changes in thermal and mechanical properties relative to virgin PLA. Preliminary work has established a solvent-assisted PLA recovery technique using ethyl acetate with disrupted polymer chain continuity. Current experimental implementation of material characterization predicts reduced thermal stability and altered mechanical performance while retaining properties suitable for additive manufacturing. By evaluating the feasibility of recycling PLA–regolith composites, this work aims to support sustainable, closed-loop manufacturing approaches for lunar infrastructure and reduce dependence on Earth-supplied materials. Future efforts will explore alternative solvents, iterative recycling, and process optimization to maximize polymer recovery and maintain material performance.

Title: Comprehensive Discrimination of Foodborne Bacteria Using Whole-Omics Profiling by LC-IM-MS/MS in Combination with Machine Learning Algorithms

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Additional Authors: Ahmed Hamid;Md Naymor Rahaman;Iffat Jerin;

Mentor: Ahmed Hamid

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College: College of Sciences and Mathematics

Abstract: Foodborne pathogens are a major cause of gastrointestinal illness, posing serious risks to public health and generating substantial economic losses. Conventional microbiological detection methods are limited by long turnaround times and insufficient discriminatory power, which can delay clinical decision-making and appropriate treatment. We previously showed that the integration of ion mobility with liquid chromatography–mass spectrometry (LC-IM-MS) enhances analytical sensitivity and resolving power, enabling improved separation of isomeric and conformational molecules and facilitating bacterial identification at the strain and sub-strain levels. In this study, we developed an LC-IM-MS–based whole-omics platform integrating lipidomics, proteomics, and metabolomics, coupled with machine-learning algorithms, for accurate identification of foodborne pathogens. The approach was applied to single cultures, co-cultures, and mixed analyses of multiple bacterial species and their respective strains, including *Bacillus*, *Salmonella*, *Campylobacter*, *Clostridium*, *Escherichia coli*, *Shigella*, *Yersinia enterocolitica*, and *Listeria monocytogenes*. Our results demonstrated that the whole-omics approach can effectively differentiate foodborne pathogens, providing novel insights and enabling real-time diagnostics of foodborne pathogens.

Title: Prenatal Cannabinoid exposure: Alterations in fetal brain development and adolescent PFC functionality

Primary Author: Adrian Courville

Additional Authors: Miranda Reed; Rachel West; Vishnu Suppiramaniam; Tia Daniels; Caroline Hawkins; Emma Redmon; Miles Wiley; Cristine Camp; Carly Parker;

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Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Cannabis is currently one of the most often used illicit drugs by pregnant women, with a 62% increase in usage from 2002 to 2014. Currently, 40 states have legalized cannabis for medical use, and 24 states have legalized cannabis for recreational use, with elevated rates of consumption being reported in those states. Additionally, while there is a growing belief that using cannabis while pregnant is safe, the preclinical research examining these underlying neurocognitive changes is limited. This is especially concerning because clinical studies indicate that developmental cannabis exposure produces enduring disruptions in glutamate-mediated neurofunctioning and cognition, with particular vulnerability in the prefrontal cortex (PFC), a region essential for decision-making and memory consolidation. We hypothesize that inhaled prenatal cannabinoid exposure (PCE) causes sex specific impairments in fetal brain development and adolescent PFC glutamatergic signaling and mediated behaviors. To test this hypothesis, we used RNA sequencing and qPCR analyses of fetal brains and adolescent PFCs, along with Y-maze spontaneous alternation and Morris Water Maze reversal tasks, to assess sex-specific changes in glutamatergic signaling, spatial working memory, and behavioral flexibility. Results from this project help advance our knowledge of how PCE affects fetal brain development and PFC function, and contribute to research highlighting potential risks of cannabis use during pregnancy.

Title: Potential Sex Based Differences in Heat Dissipation Behavior in Zebra Finches

Primary Author: Adrienne Blume-Babcock

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Mentor: Haruka Wada

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Increasing ambient temperature is threatening animals around the globe, especially for those living in regions where the temperature is already near the upper thermal limits of the species. Even at sublethal temperatures, population growth can be impaired if sexes differ in temperature tolerance that affects behavior or reproductive capacity. However, sex differences in temperature tolerance are not well understood. We hypothesized that female zebra finches have decreased capacity in their ability to endure heat stress, in comparison to male zebra finches, and that their heat-dissipating behaviors will reflect this. To test this, male and female Zebra finches were exposed to 5 hours of high heat (43°C) or kept at room temperature (22°C; controls). Their internal body temperature was measured using passive integrated transponder (PIT) tags, and their behavior was recorded during the 5-hour duration. The percentage of time spent panting, engaging in escape behavior, and the frequency of piloerections were recorded. We predict that female zebra finches will have a higher percentage of time spent in and an earlier onset of heat-dissipating behaviors than male zebra finches. We also predict that the percentage time spent in these behaviors will be positively correlated with body temperature.

Title: The US Beekeeping Survey: Integrated pest management for Varroa is associated with lower colony losses.

Primary Author: Agostina Giacobino

Additional Authors: Geoffrey Williams;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Long-term monitoring of managed *Apis mellifera* honey bee colony losses is critical for documenting the magnitude of this globally significant issue. Since 2024, the Auburn University Bee Center has continued previous efforts by leading the U.S. Beekeeping Survey, designed to estimate colony losses in the United States. The survey also provides a platform to collect data on management practices across regions and operation types, particularly those related to Varroa destructor management, which is a major threat to the beekeeping industry. We analyzed 1,442 and 2,318 responses from the 2023-2024 and 2024-2025 surveys, respectively. Operations were classified as large-scale (>50 colonies) or small-scale (≤ 50 colonies), with large-scale subdivided into single-state (SS) and multi-state (MS). We described mite management practices by group and evaluated associations with winter losses using a generalized linear mixed model. About half of large-scale MS operations relied primarily on varroacides, and 70–80% reported monitoring colonies; however, many treated on a calendar-based schedule without considering infestation levels. In contrast, only 30% of large-scale SS operations relied mainly on varroacides, with 60–70% reporting colony monitoring. Small-scale operations showed strong regional variation; 40–79% integrated chemical and non-chemical methods, most often organic acids and screened bottom boards. Between 40–70% monitored annually, and calendar-based treatments were less common than in large-scale operations. Across all beekeeper groups, incorporating monitoring results alongside calendar-based treatment decisions ($\chi^2 = 10.43$, $P = 0.001$) and rotating more than one active ingredient ($\chi^2 = 21.53$, $P = 0.001$) were associated with lower winter losses. Effective *V. destructor* control remains a priority in managed honey bee colonies, and evaluating current practices can inform the development of targeted educational programs that promote integrated pest management.

Title: Antihypertensive treatment patterns before and during pregnancy among women with chronic Hypertension: A real-world EHR study

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Mentor: Matthew Loop

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College: Harrison College of Pharmacy

Abstract: Clinical guidelines for the management of chronic hypertension in pregnancy differ in their recommendations for first-line antihypertensive therapy. Labetalol, nifedipine, and methyldopa are commonly recommended, but their prioritization varies across organizations. Describing real-world antihypertensive use before pregnancy and across gestation is important for understanding current practice and informing future guideline development. We conducted a retrospective cohort study using electronic health record data from the University of Alabama at Birmingham from 2016 to 2025. Pregnant individuals with chronic hypertension were identified using validated diagnosis codes recorded before or at 20 weeks' gestation. Antihypertensive medication use was evaluated during the pre-conception period and across the first, second, and third trimesters. Among 556 pregnant women with chronic hypertension, antihypertensive treatment before conception was primarily composed of calcium channel blockers and beta-blockers, with amlodipine (30.7%), nifedipine (24.4%), and labetalol (20.3%) being the most commonly prescribed medications, while renin–angiotensin system inhibitors remained in use. Compared with the pre-conception period, medication distributions differed significantly in the first trimester ($p < 0.001$), during which labetalol became the most frequently used agent (42.6%), followed by nifedipine (31.6%) and amlodipine (18.8%). Medication use continued to change across pregnancy, with significant differences observed between the first and second trimesters ($p < 0.001$) and between the second and third trimesters ($p < 0.001$). Methyldopa use was rare throughout pregnancy ($<0.3\%$). Overall, antihypertensive prescribing patterns shifted from pre-conception to pregnancy toward agents more commonly recommended during pregnancy, particularly labetalol and nifedipine, while continued use of non-first-line agents highlights persistent variability in clinical practice.

Title: Potential consequences of managing wild birds through socially facilitated habitat selection

Primary Author: Aidan Kay

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Mentor: Jonathon Valente

Department/Program: ALA COOP Fish and Wildlife Unit

College: College of Forestry, Wildlife and Environment

Abstract: The Marbled Murrelet (*Brachyramphus marmoratus*; hereafter murrelet) is a small seabird that nests in old growth trees along the Pacific coast between central California and Alaska. Evidence suggests that, like other members of the auk (*Alcidae*) family, they use conspecific social cues to select breeding sites. Thus, there is strong interest in broadcasting vocalizations to encourage this threatened species to nest in high-quality protected habitat, provided this management action does not create an ecological trap by simultaneously attracting nest predators. Here we test the hypothesis that simulated murrelet calls can inadvertently attract nest predators to potential murrelet breeding areas. During the breeding season of 2016, we selected 28 sites in coniferous forests along the Oregon coast based on proximity to known murrelet nests and purported habitat quality. At each site we deployed a playback and recording device (PRD), which broadcasts calls and records ambient sounds. At 14 control sites the PRDs only recorded audio, and at the remaining sites, they both recorded and broadcasted murrelet calls intermittently throughout the mornings. We then analyzed the recordings and documented detections of all wild murrelets and four corvid species. We found no evidence that detections of American Crow (*Corvus brachyrhynchos*) or Common Raven (*Corvus corax*) differed between control and treatment sites. Conversely, we did find that the proportion of days on which jays were detected differed. Steller's Jays (*Cyanocitta stelleri*) were recorded on 22.04% (SD = 10.59) of days at control sites and 39.07% (SD = 25.03) at treatment sites while Canada Jays (*Perisoreus canadensis*) were recorded during 1.45% (SD = 1.17) and 3.58% (SD = 2.34) of days at control and treatment sites, respectively. These findings suggest simulated social cues have the potential to create ecological traps by attracting both murrelets and their nest predators to the same locations.

Title: Long-Term Cover Crop Effects on Soil Organic Matter Composition and Quality

Primary Author: Aishwarya Goli

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Mentor: Thorsten Knappenberger

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Cover crops (CCs), as a long-term sustainable agricultural practice, play a key role in enhancing soil organic matter (SOM). CCs add SOM directly through aboveground residue decomposition, root exudates, and indirectly by stimulating microbial activity. Decomposition of different CC residues exhibits distinct functional traits and contributes differently to SOM and water-extractable organic matter (WEOM) production and composition. The objective of this study was to quantify how CC species and soil depth affect the composition of SOM and WEOM in soils from a seven-year cover cropping system at two sites in the southeastern United States, using spectroscopic techniques that require no or minimal soil-sample pretreatment. Soil samples were collected in November 2024 at two depths (0–10 cm and 10–30 cm) from an ongoing long-term field experiment established in 2017. This study included winter fallow, cereal rye <<(Secale cereale L.)>>, crimson clover <<(Trifolium incarnatum L.)>>, and radish <<(Raphanus sativus L.)>> as monocultures and a mixture of the three species. WEOM was extracted from soil samples to characterize dissolved organic carbon (DOC) concentration, total nitrogen (TN), UV–VIS absorbance, and fluorescent components identified by parallel factor analysis. FTIR spectroscopy was used to characterize the SOM composition of the samples. Significant differences were observed across depths, with topsoil exhibiting more humified and aromatic DOC and higher N concentrations, whereas no significant differences were detected among CC treatments. Clear differences in OM composition were observed among sites, driven primarily by soil texture, mineralogy, cash-crop history, and management practices such as tillage, whose effects outweighed those of CC species on OM quantity and composition. These results highlight the need for longer-term, process-based studies to disentangle CC effects from dominant-site and management-driven controls on SOM and WEOM dynamics.

Title: Phylogenetics relationship within the Asian fish genus *Mystus* (Scopoli 1777)

Primary Author: Akila Abesinghe

Additional Authors: Jonathan Armbruster;

Mentor: Jonathan Armbruster

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The genus *Mystus* (family Bagridae) comprises a diverse group of freshwater catfishes distributed across South and Southeast Asia, with a limited presence in West Asia. Despite this broad range, morphological differentiation among *Mystus* species is minimal, complicating taxonomy and obscuring evolutionary relationships. Previous phylogenetic studies have produced conflicting hypotheses regarding the monophyly and systematic placement of the genus. In this study, we investigate evolutionary relationships within *Mystus* using genome-wide restriction site-associated DNA sequencing (RAD-seq). Phylogenomic analyses recover *Mystus* as a largely monophyletic group, with the exception of *Mystus leucophasis*, which is placed outside the core *Mystus* clade. The widely distributed species *Mystus gulio* is recovered as potentially monophyletic across its geographic range. Overall, the *Mystus* complex is structured into two primary clades. Within one of these clades, the three Middle Eastern *Mystus* lineages form a monophyletic subclade, and all Sri Lankan *Mystus* species are recovered as distinct evolutionary units. These results provide phylogenomic support for the monophyly of *Mystus sensu stricto*, clarify relationships among *Mystus* lineages, and reveal taxonomic inconsistencies within the genus. This study improves our understanding of *Mystus* evolutionary history and provides a foundation for future systematic and taxonomic revision within Bagridae.

Title: Engineering a PD-1-dependent 4-1BB agonist for combination immunotherapy

Primary Author: Alana Kramer

Additional Authors: Payal Agarwal;Jonathan Marable;Damien Ruiz;

Mentor: Maninder Sandey

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: First-generation 4-1BB (CD137) monoclonal antibody-based agonists showed significant potential by eliciting robust anti-tumor responses in early preclinical and clinical studies. However, their clinical development was hampered by dose-limiting hepatotoxicity, attributed to the systemic activation of 4-1BB receptors on monocytes, which recruited CD8⁺ T cells to attack hepatocytes. To address this challenge, next-generation therapies have focused on decoupling the hepatotoxic effects of 4-1BB activation from its anti-tumor activity. These strategies utilized bispecific molecules to bind tumor-associated antigens, facilitating the hyperclustering and trimerization required for 4-1BB activation while localizing to the tumor microenvironment. In this study, we introduce a PD-1-targeted 4-1BB agonist platform that leverages the PD-1 receptor on exhausted T cells to facilitate 4-1BB activation. Three murine-specific bispecific constructs were developed, each employing an anti-PD-1 nanobody for crosslinking and trimerization of 4-1BB. Construct 1 was designed to function as a weak agonist in the absence of PD-1, transforming into a strong agonist in its presence. In contrast, constructs 2 and 3 are dependent on PD-1 for hyperclustering and subsequent 4-1BB activation. The constructs were expressed and purified using Expi293F-based stable cell lines. Flow cytometry confirmed binding specificity to the cognate 4-1BB and PD-1 receptors. A 4-1BB luciferase bioassay demonstrated the PD-1 dependency of constructs 2 and 3, which showed no activity in the absence of PD1-expressing cells but became potent agonists when present. Construct 1 activated 4-1BB independently of PD-1, with enhanced activity in its presence. All constructs effectively blocked the PD-1/PD-L1 interaction. In vivo analyses with constructs 1 and 2 in mouse xenograft models demonstrated increased anti-tumor responses compared to the isotype control, with no overt histological evidence of hepatotoxicity.

Title: Evaluation of CYP3A4 induction from Kratom — HIV antiretroviral drug interaction using quantitative PCR

Primary Author: Alexander Shipp

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Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Kratom, *Mitragyna speciosa* Korth, a tropical tree native to Southeast Asia, gained popularity in the United States for its psychoactive properties and potential therapeutic benefits. However, the use of kratom with antiretroviral (ART) drugs for HIV treatment raises concerns about potential pharmacokinetic interactions. Kratom contains mitragynine, the major bioactive alkaloid, which can interfere with drug metabolism in hepatocytes. Hepatocytes are the chief functional cells of the liver and are responsible for completing metabolic functions, and they deliver more clinically translational data in terms of measuring CYP enzyme activity. Previously, the experimental design was developed and optimized using various medium and overlays. The most reproducible hepatocyte culturing environment and control parameters were determined and implemented in this current work. To evaluate CYP induction from the individual components of this study, human hepatocytes were plated using the previously optimized cell culture conditions and Kratom or HIV ART drug was administered for a 48-hour treatment period. Genetic material in the form of mRNA was extracted from hepatocytes for quantitative polymerase chain reaction (qPCR) analysis to determine the cycle quantification (Cq) of each treatment. Using the delta-delta Ct method, the relative expression of CYP3A4 was analyzed and statistical significance was determined via one-way ANOVA. High concentrations of Kratom (> 20-fold concentration of activity) and mitragynine (> 2.74 concentration of activity) were found to induce CYP3A4 expression. These findings indicate a possible risk of HIV ART drug and Kratom interactions in combination, leading to a decrease in the efficacy of HIV ART drugs for people living with HIV.

Title: The Sport of Weight Pull: Canine Kinematics Based on Weight Pulled and Pull Form.

Primary Author: Alexandra Neff

Additional Authors: Heidi Kluess;Wendi Weimar;

Mentor: Heidi Kluess

Department/Program: School of Kinesiology

College: College of Education

Abstract: Weight pull is a sport and activity for strength development in dogs and biomechanics is a tool that may aid in strength development and technique optimization. The purpose of this project was to apply biomechanics to understand techniques employed by dogs in weight pull activities. Pilot work has identified 3 pull styles: Style 1-all paws on ground; Style 2-two paws in air; and Style 3-all paws off ground. We hypothesize 1) that increased load will reduce average distance (avg dist) covered in the first 2 strides and 2) that Style 1 will have the smallest right rear ankle angle (RRAA) compared to Style 2 and 3. We recruited 8 dogs (age: 3 ± 2 yrs; 4M/4F; body weight (bw): 26 ± 6 kg; 5 expert/3 novice) at a 4-day weight pull competition. Dogs were required to have 2 successful pulls on the same day with >30 kg difference in load between pulls. We analyzed videos for right rear paw placement to get the avg dist covered in two strides (3, same foot, foot falls) in two differently weighted pulls. RRAA was measured at cart motion initiation across the three pull styles. Data was analyzed using T-test, regression analysis and a one-way ANOVA. For all dogs, avg dist was shorter for the heavier load (27 ± 10 Xbw; 23.7 ± 8.8 cm) than the lighter load (14 ± 3 Xbw; 34.2 ± 9.9 cm; $T=3.09$, $p=0.02$). A regression analysis suggested that as load increases, stride length gets smaller ($Y=-0.57x+40.7$; $R=0.29$, $p=0.04$). We analyzed RRAA by pull style using a one-way ANOVA. RRAAs were significantly different between Style 1 ($111\pm 7^\circ$) and Style 2 ($130\pm 5^\circ$; $p=0.01$) and Style 1 and Style 3 ($135\pm 15^\circ$; $p=0.007$), but not between Style 2 and 3. We found that dogs adopted smaller strides at heavier loads regardless of experience. Style 1 had smaller ankle angles compared to Style 2 or 3. This information advances understanding of dog self-selected pulling styles and joint position. Future research should consider this data within the confines of injury mechanisms and performance for dogs.

Title: Molecular mechanisms underlying enhanced sperm activation by ovarian fluid in a teleost fish *Ictalurus furcatus*

Primary Author: Alexandra Nowicki

Additional Authors: Ian Butts;

Mentor: Ian Butts

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: For most externally fertilizing teleost fish, sperm remain immotile until release into the external environment, where changes in osmolality and ionic concentrations trigger activation. The presence of ovarian fluid (OF) enhances sperm swimming performance in many species, including blue catfish (*Ictalurus furcatus*), enabling cells to swim longer and at higher velocities than in water alone. This study aimed to identify genes and molecular pathways associated with sperm performance when cells were activated in 25% OF compared to deionized water (dH₂O). We hypothesized that the biochemical properties of OF instigate regulation of key signaling pathways and ion channels during sperm activation that are critical for motility and fertilization potential. Sperm and OF from three males and three females were factorially combined. Sperm swimming performance was assessed under the following treatments: OF control (50 μ L sperm : 500 μ L OF), dH₂O control (50 μ L sperm : 2000 μ L dH₂O), and 25 % OF treatment (50 μ L sperm : 500 μ L OF : 1500 μ L dH₂O). Samples were lysed at 30 s post-activation to stop transcription, and RNA sequencing was performed with an Illumina platform in a 2x150 bp configuration. Sperm showed improved performance when activated in a 25% OF solution compared water alone. A total of 2,410 genes and 1,384 transcripts were differentially expressed between 25% OF and dH₂O control treatments. Enriched gene ontology pathways identified in OF activation have roles in the form and function of flagella, tail motility, ion channels and signaling pathways, chemotaxis, and energy efficiency. KEGG pathway analysis further identified enrichment of metabolic and signaling pathways such as ECM receptor-interaction, CAM, and MAPK, that have crucial roles in sperm motility regulation. These findings provide novel insight into mechanisms that are influenced by biochemical properties of the environment which enhance blue catfish sperm activation and performance.

Title: Can I Do this? Navigating Imposter Syndrome in Mental Health Professionals

Primary Author: Alexis Duke

Additional Authors: Trenton Singletary; Alexis Dowdell;

Mentor: Danielle Boyd

Department/Program: Counseling Leadership and Special Education

College: College of Education

Abstract: Imposterism (IP) is highly prevalent among counselors in training, with recent findings indicating that 96.1% report experiencing imposteristic thoughts and feelings (Hartley, Button, & Clark, 2024). Existing literature demonstrates that IP is associated with diminished professional confidence, increased burnout, social isolation, and erosion of counselor identity, factors that may hinder trainee development and compromise the quality of client care (Barari et al., 2024; Clark et al., 2024; Gardner, 2019). Despite its widespread impact, limited attention has been given to systematically addressing imposterism within counselor education through intentional and developmentally responsive approaches. This literature review synthesizes current empirical findings on imposterism in counseling trainees and highlights culturally responsive and evidence informed strategies for targeted intervention and support within counselor education programs. Implications for counselor educators, supervisors, and training programs are discussed, with an emphasis on fostering professional identity development, wellness, and resilience among counselors in training.

Title: Soft Tactile Endoscopic Probe for In Vivo Real-Time Mechanical Mapping and Detection of Submucosal Colon Tumors

Primary Author: Alexis Florit

Additional Authors: Tofayel Ahammad Ovee;

Mentor: Jean-Francois Louf

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: A standard colonoscopy relies on surface level biopsy sampling and visual inspection to identify tumors or lesions that may indicate colorectal cancer. A significant limitation of this approach arises when tumors are located beneath the mucosal surface of the colon, and these tumors often go undetected until they have progressed to later stage colorectal cancer. This study investigates a novel diagnostic technique that measures localized pressure responses as an indirect measure of underlying tissue stiffness. The method uses a water-inflatable, silicone-based probe tip that applies controlled inflation against the colon wall. Areas with underlying tumors exhibit elevated pressure readings in comparison to adjacent healthy tissue. Initial experimental results demonstrate that stiffness based detection is possible up to 2 mm beneath the colon wall. This technique can be easily integrated into existing colonoscopic devices, and has the potential to enhance early detection of submucosal tumors that might ordinarily be missed.

Title: Worker polymorphism and pathogen pressure: Does worker caste predict susceptibility to a fungal entomopathogen in *Solenopsis invicta*?

Primary Author: Alice Raybosh

Additional Authors: Clint Penick; Darmon Kahvazadeh;

Mentor: Clint Penick

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The red imported fire ant (*Solenopsis invicta*) is one of the most ecologically and economically damaging invasive insects in the southeastern United States, yet its success depends in part on how individual workers resist disease. Entomopathogenic fungi such as *Beauveria bassiana* are promising biological control agents, but their effectiveness may be limited by variation in susceptibility within ant colonies. This study tested whether worker caste influences vulnerability to fungal infection. Worker ants were collected from five colonies across Auburn, Alabama, with each colony contributing both minor and major workers classified by head width. For each caste within each colony, ants were assigned to seven treatments, six fungal concentrations ranging from 10^3 to 10^8 conidia per mL and a Tween control, with eight individuals per treatment, 56 ants per caste per colony, and exposed via submersion under controlled laboratory conditions. Ant survival was monitored daily. Mortality increased with fungal concentration, while control groups exhibited minimal mortality. Overall, minor workers exhibited higher mortality than major workers across fungal treatments, indicating greater susceptibility to fungal infection. These results suggest that size-based worker polymorphism plays an important role in pathogen resistance and that within-colony variation may contribute to colony-level disease resilience. By identifying caste-specific vulnerability, this research advances understanding of social immunity and highlights how fungal-based biological control strategies may be refined to target invasive fire ant populations more effectively.

Title: Exploring the impact of multiple military deployments on veterans' trust in the Department of Veterans Affairs

Primary Author: Alisa Clark

Additional Authors:

Mentor: Jennifer Robinson

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Trust in the U.S. Department of Veterans Affairs (VA) is critical for veterans' engagement with government healthcare services, yet the extent to which military service characteristics shape this trust remains unclear. This study examined whether the number of deployments, deployment duration, VA disability rating, and other service-related factors were associated with trust in the VA. Hierarchical linear regression models assessed the incremental contribution of these variables beyond demographic controls. Age and gender were entered first, followed by number of deployments, deployment durations (total months deployed and longest deployment), disability rating, branch of service, military status, and rank. Interaction terms tested whether deployment duration or disability burden moderated the association between deployment count and VA trust. Results indicated that age and gender did not explain significant variance in trust. The number of deployments was not independently associated with VA trust, nor did it improve model fit beyond demographic factors. Adding deployment duration, disability rating, and service characteristics did not strengthen explanatory power, and the overall models accounted for minimal adjusted variance. Interaction terms including total months deployed and disability rating were also nonsignificant. Although some rank-related coefficients reached nominal significance, these effects did not notably improve model performance. Overall, these findings suggest that commonly measured indicators of military service exposure, such as deployment count and duration, are insufficient to explain variability in veterans' trust in the VA. Trust in government healthcare systems among veterans may be shaped more strongly by post-service experiences and interactions with the VA. These results highlight the need for future research to examine healthcare system factors, care quality, and administrative experiences when examining determinants of VA trust.

Title: Assessment of host adaptation by a bacterial plant pathogen

Primary Author: Allison Belviy

Additional Authors: Mamata K C;

Mentor: Leonardo De La Fuente

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: *Xylella fastidiosa* (Xf) is a bacterial plant pathogen that causes Pierce's Disease in grapevines and affects a large host range. Pierce's Disease has been present in the US for over 150 years, and this pathogen has recently expanded to Europe, causing agricultural losses. The main issue with this bacterium is that the only method of control is to attack the insect vector, most commonly sharpshooters, which feed on the xylem of infected plants, spreading the bacterium. Because of this, the question of whether strains originating from one host plant can adapt to and inhabit another host plant is important. This was addressed by using four different Xf strains, originally isolated from grapes and almonds, in the model plant tobacco. Three strains were naturally competent, meaning they can pick up DNA from the environment, and were marked with an antibiotic resistance cassette for tracking. The fourth strain used is not naturally competent and was left unmarked. First, I conducted in vitro experiments of serial passages to simulate natural conditions using grape sap and assess how different strains grow in this medium. This showed different levels of growth to compare with the in vivo stage of the project. The strain Dixon showed the most growth, and IVIA5770 showed the least growth from these passages. Next, I am currently conducting in vivo experiments by infecting tobacco plants with each strain to assess the disease severity involving both qualitative evaluation of symptoms and quantitative measurement of bacterial load using qPCR. From the passage experiments, it is suggested that the strains from almonds, B3SN17.2 and Dixon, have a higher growth in grape sap compared to strains originally from grapes, TemeculaL and IVIA5770. My research is contributing to the understanding of host preferences by this devastating plant pathogen.

Title: Brechtian Broadway: the Alienation Effect in modern musical theater

Primary Author: Alma Sorek

Additional Authors:

Mentor: Bettina Christner

Department/Program: Foreign Language

College: College of Liberal Arts

Abstract: This project examines the role and potential application of German theatrical theorist Bertolt Brecht's Alienation Effect in modern musical theater, using three musicals from the past 60 years as examples: *Cabaret* (1966), *Little Shop of Horrors* (1982), and *Hadestown* (2016). Mainstream musical theater and Brecht's academic theatrical theories have, as yet, often been held separate in the literature; there exists no scholarship bridging the two together. This is important as it allows for a new, more accessible application of the Alienation Effect, currently stuck in academic and highbrow theatrical circles, as well as a better understanding of the impact of contemporary musical theater pieces. This enhances theatrical performers' and creatives' ability to elicit critical engagement from general audiences by identifying practical strategies and giving examples of them. This project demonstrates the use of the Alienation Effect in the aforementioned texts using textual and performance analysis as well as audience interviews. The Alienation Effect seeks to emotionally distance the audience from the happenings onstage, encouraging instead critical reflection on the socioeconomic conditions that have led to the situations depicted in the show. The stilted mannerisms of Ellen Greene's Audrey in *Little Shop of Horrors* show her as a figure representing socioeconomic conditions rather than a real, sympathetic person. *Cabaret*'s disjointed scenes emphasize the unnatural spectacle of the play. Fourth wall breaks in *Hadestown* draw viewers into an active role. The audience interviews show the real effects and audience reaction to these moments. Across all three shows, the Alienation Effect is present and used, eliciting strong reactions from audiences. This analysis therefore demonstrates new avenues for engagement with the Alienation Effect through popular theater that have been overlooked until now.

Title: Keel Bone Injuries in Broiler Breeder Hens

Primary Author: Alyssa Dyer

Additional Authors:

Mentor: Bethany Baker

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Keel bone injuries are a major welfare concern in poultry, particularly in laying hens, and have been found to be prevalent in 53-98% of the flock. To date, no studies have been conducted on keel bone injuries in broiler breeders. The occurrence of keel bone injuries has been attributed to housing design (primarily aviary-style housing), egg production, egg size, and stress, among other things. The prevalence and origin of keel bone injuries in broiler breeder hens are unknown. Broiler breeders are kept in a different housing system than laying hens. Thus, keel bone injuries in broiler breeders are more likely to result from egg production and stress rather than from housing. The keel bones of 200 broiler breeder hens that were raised either in small social groups or large groups and were either naturally mated or artificially inseminated have been dissected. A scoring method was created that looked at deviations, fractures (caudal, middle, and cranial), tip conditions, and the calluses. The data has been analyzed using descriptive statistics, chi squared, and a person-spearman correlation. Keel bone deviations were very prevalent, and occurred in 90% of the hens. Fractures were common in the cranial (94%), middle(58%), and caudal(40%) regions. Injury to the tip occurred in 100% of the birds, and there was a callus formation present in 72% of the keel bones. The severity of deviations showed to be strongly associated with the presence of middle region fractures ($\chi^2=35.21$, $P<0.01$) only, and the presence of deviations had a moderate strength relationship with fractures in all three regions and the prevalence of tip damage. In conclusion, this research reveals that keel bone injuries are highly prevalent in broiler breeder hens with deviations, fractures, tip injuries, and calluses present when examined. In this study, the birds were kept on the ground, but yet the majority of them suffered from keel bone injuries, which shows factors beyond their housing design are contributing.

Title: Ammunition from the pathogen's weaponry: Diversity of type-III secreted effectors

Primary Author: Amanpreet Kaur

Additional Authors:

Mentor: Neha Potnis

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The type III secretion system (T3SS) is a conserved, specialized nanomachine and a central determinant of virulence across most Gram-negative bacteria. This system enables the direct translocation of bacterial effector proteins into plant host cells, where they suppress or evade host defense responses and promote disease development. In plant-pathogenic bacteria, T3SSs are encoded by hrp (hypersensitive response and pathogenicity) genes, which are essential for both disease establishment in susceptible hosts and eliciting hypersensitive responses in resistant plants. Modern agriculture increasingly relies on the deployment of resistant crop varieties as a sustainable strategy for disease management. However, this approach often fails to account for the rapid evolutionary capacity of bacterial pathogens, which can overcome host resistance within a few growing seasons through effector diversification and selection. Bacterial leaf spot of tomato and pepper in the United States exemplifies this challenge. The disease is caused by four distinct *Xanthomonas* species distributed across different geographic regions, each harboring a functional T3SS and a diverse effector repertoire. While T3SSs and individual effectors have been well characterized within single *Xanthomonas* species, a comparative analysis of effector diversity, selection, and diversification across all four species remains lacking. In this study, we identified core T3SS effectors shared within and among these species and characterized their sequence, structural, and functional diversity using machine-learning-based prediction tools. We further examined spatial and temporal variation in effector diversity using real-time field samples. This integrative framework provides insights into pathogen adaptation dynamics and underscores the need to understand cross-species effector variation to inform the development of durable, broad-spectrum resistance strategies.

Title: Tensile strength of ligating loops constructed with large gauge suture

Primary Author: Ana Jimena Munoz Zuniga

Additional Authors: Sarah Kooy; Reid Hanson; Lindsey Boone;

Mentor: Lindsey Boone

Department/Program: Large Animal Hospital

College: College of Veterinary Medicine

Abstract: Tensile strength of ligating loops constructed with large gauge suture. Zúñiga J, DVM1; Kooy S.I. DVM, MS1; Farag R, PhD2; Hanson R, DVM, DACVS, DACVECC1; Gillen A, MS, VetMB, DACVS; Boone L, DVM, PhD, DACVS-LA1 1Department of Clinical Sciences, Auburn University, Auburn, Alabama 2Department of Polymer and Fiber Engineering, Samuel Ginn College of Engineering, Auburn University, Auburn, Alabama The ability to tie a secure knot is an essential surgical skill for every surgical procedure performed; yet the knot has been shown to be the weakest part of the suture line. Knot configuration as well as suture type and size affect knot security. Knot security may affect the tensile strength of a ligating loop with knot configuration playing a significant role in knot security. Clinician experience and personal preference also contribute to suture choice. Despite the importance of secure ligation, there is limited research evaluating the tensile strength of ligating loops with differing knot configurations using large gauge suture. For equine practitioners, achieving a strong and secure ligation of the spermatic cord is essential to prevent postoperative complications such as hemorrhage and eventration following castration. The aim of this study was to compare the tensile strength of different knot configurations used for ligation with large gauge suture to determine which construct provides the greatest strength. We hypothesized that the Modified Miller's knot would provide greater tensile strength than the strangle knot, surgeon's knot, sliding knots or self-locking knots. Additionally, we hypothesized that multifilament suture (polyglactin 910, Vicryl) and larger suture size (1 USP) would yield greater tensile strength compared with monofilament suture (polydioxanone PDS) and smaller suture size (0 USP). Encircling ligations were tied with either standard surgeon's knot (SX), binding knot (Modified Miller's knot, MM), sliding knot (Giant GT and 4S Modified Roeder 4SMR), ligation tied with a standard surgeon's knot (SX), binding knot (Modified Miller's, MM), strangle knot (SK), or self-locking knot (Double forwarder knot, DF) using 0 USP and 1 USP Polydioxanone (PDS) and Polyglactin 910 (Vicryl). Each ligating loop was mechanically tested under linear tension to failure. Data was tested for normality. ANOVA and post hoc testing were used to compare strength between suture, suture size, and knot type. $P < 0.05$ was considered significant. There were significant differences in measured minus maximum force between knot types for each suture type/size combination ($p < .0001$ all). Within each suture type/size combination measured minus maximum forces were significantly higher in modified Miller's and strangle knots compared to the other 4 knot types. Vicryl Size 1 modified Miller's measured minus maximum forces were significantly higher than the strangle knot. Size 1 knot measured minus maximum forces were significantly higher than size 0 knots ($p < .0001$). In conclusion, when ligation of the spermatic cord is indicated during routine equine castration, use of a binding knot, such as the modified Miller's knot should be considered as it provides superior tensile strength compared with other commonly used knot configurations.

Title: Beyond metacognitive awareness: The central role of the phonological lexicon in early reading

Primary Author: Andrea Forehand

Additional Authors: Victoria Cardullo;

Mentor: Victoria Cardullo

Department/Program: Department of Curriculum and Teaching

College: College of Education

Abstract: The combined effect of orthography, phonology, and semantics on reading has been well researched. The focus of this present study is the singular effect of the phonological lexicon on initial decoding and students' awareness of metacognitive processes while reading. The question at hand: Does the quality of a student's phonological lexicon impact automatic decoding is investigated using a quasi-experimental design in the Southeast United States for four weeks. The class had 19 students. Of the 19 students, 14 are African American, and five are Hispanic. Students participated in 10-minute phonological awareness training sessions three days per week. Each week, following the three days of phonological training, students were given a pseudoword reading assessment. Following the week-two assessment, seven students were randomly chosen and asked a series of interview questions to provide a more thorough understanding of how having a phonological representation of one word set, but not the other, supported word reading. Data collected over the four weeks showed that students had fewer errors and higher fluency rates on the trained set of pseudowords despite students' inability to express their metacognitive processes. The data from this research sheds light on the importance and impact of language in the classroom. Educators can positively impact students' decoding ability by being word-conscious and elevating and expanding the vocabulary they use every day.

Title: Evaluating Soil Carbon and Nitrogen Accretion Under an Oat-Rye Cover Crop System

Primary Author: Anh Nguyen

Additional Authors: Rishi Prasad;

Mentor: Rishi Prasad

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Benefits of conservation agriculture practices on soil health indicators, such as carbon (C) and nitrogen (N) sequestration, may not be immediately apparent, as ecological systems require time to adapt. To address this, a four-year (2021-2024) paired-watershed study compared the effects of a recommended oat-rye cover crop mixture (R) against a standard farmer practice of an oat monoculture (F) on total soil C and N accumulation. Static soil core data taken at different depths showed no statistically significant differences between the practices. However, monitoring the watersheds over time revealed a multi-stage process. A static assessment of soil cores sampled at six depth increments (5.1 cm to 61.0 cm) found no statistically significant differences ($p > 0.05$) in SOC or TN between the practices. However, watershed-scale monitoring over time revealed a critical, multi-phase process. Initial implementation of practice R induced a transient decline in SOC, likely attributable to the accelerated mineralization of native SOC. This transitional phase was followed by a substantial net gain; in its second year, mixture practice exhibited the largest single-year accumulation rates observed, sequestering nearly 10 Mg/ha SOC and over 1.1 Mg/ha TN, confirming significant net accumulation. This observation was supported upon converting the second watershed from F to R, which replicated the transient SOC decline but also produced a concurrent and significant increase in TN stock (745 kg/ha), highlighting a rapid enhancement of N retention even during the SOC transitional phase. The recommended oat-rye mixture appears to be an effective practice for initiating SOC and TN accretion, key indicators of soil health and fertility. This study underscores the importance of long-term ecosystem-scale monitoring to properly quantify agroecosystem responses, as reliance on static soil profile sampling alone may obscure the substantial, cumulative benefits of advanced conservation systems.

Title: A Perceived Value-Based Model of 3D-Printed Product and Technology Adoption

Primary Author: Anik Barua

Additional Authors: Veena Chattaraman;

Mentor: Amrut Sadachar

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: As 3D printing shifts from industrial uses to consumer markets, firms need insight into why shoppers adopt 3D-printed products across product categories. This conceptual paper proposes a perceived value-based model in which two perceived benefits, customization and innovativeness, shape consumers' behavior. We argue that perceived customization increases buying behavior by strengthening consumer involvement and satisfaction in the creation process. We also argue that perceived innovativeness increases buying behavior by signaling uniqueness and novelty. Further, these benefit perceptions operate through three value pathways: functional value, emotional value, and epistemic value. Functional value reflects improved fit and utility, emotional value reflects pride and psychological ownership, and epistemic value reflects curiosity and stimulation. Together, these value dimensions mediate the effects of customization and innovativeness on buying behavior. From the managerial perspective, this study provides insights for building interactive 3D printing platform enabling consumer co-creation and solidifying purchase intentions.

Title: Mechanical energy analysis of dual-task walking: Age-related differences in movement efficiency

Primary Author: Anna Black

Additional Authors: Wendi Weimar; Kenneth Harrison; Grace Greer; Marigrace Crossett;

Mentor: Wendi Weimar

Department/Program: School of Kinesiology

College: College of Education

Abstract: Older adults demonstrate a distal-to-proximal shift in joint power generation during walking, relying more on hip extensors than ankle plantarflexors for propulsion. Dual-task walking, which requires divided attention, may further compromise ankle function. This study examined age-related differences in ankle energetics during self-selected and dual-task walking conditions. Twenty-one participants (11 younger adults: 23.4 ± 2.1 years; 10 older adults: 71.3 ± 5.8 years) walked on an instrumented treadmill at self-selected speed during single-task (ST) and dual-task (DT; verbal fluency) conditions. Three-dimensional gait kinematics and kinetics were collected using motion capture and force plates. Inverse dynamics quantified ankle work ratios (positive/negative work), and A2 ankle power peaks. Independent t-tests compared groups at baseline and for dual-task costs (percent change from ST to DT). Younger adults demonstrated higher A2 ankle power peaks (2.53 ± 0.32 vs 1.73 ± 0.37 W/kg; $p < 0.001$, $d = 2.34$) and superior ankle work ratios indicating greater mechanical efficiency (2.20 ± 0.85 vs 0.77 ± 0.29 ; $p < 0.001$, $d = 2.20$). A2 ankle power declined 16% in older adults but remained stable in younger adults ($p = 0.097$, $d = 0.77$). These findings add to the evidence showing that older adults may have reduced automaticity when walking, which results in larger cognitive demand. This could lead to dysfunction in the motor control of gait, leading to higher variability and asymmetries between limbs. This results in worse lower limb energy efficiency, causing older adults to have reduced mobility and fatigue quicker. It may be valuable for clinicians to include cognitive or dual task training in rehabilitative settings to offset dysfunction caused by age.

Title: An analysis of fluoride concentrations in Auburn and surrounding water systems compared to recommended EPA levels

Primary Author: Anna Claire Fitts

Additional Authors:

Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Community water fluoridation is a widely used public health strategy to reduce dental caries (i.e., cavities) in children; however, maintaining fluoride concentrations within recommended ranges is essential to maximize benefit while minimizing potential harm. Excess fluoride exposure may result in adverse effects, most commonly dental fluorosis, a condition characterized by visible changes in tooth enamel during development. Fluoride enters water systems either naturally through groundwater or through controlled fluoridation during treatment. In this study, a water system is defined as a municipal public drinking water supply managed by a local utility and serving a specific geographic community. Publicly available Consumer Confidence Reports were analyzed from 16 community water systems in Auburn, Alabama, and surrounding areas to assess alignment with Environmental Protection Agency (EPA) recommended fluoride levels. Fluoride concentrations varied across systems, ranging from 0.06 mg/L in the Loachapoka Water Authority system to 1.9 mg/L in the Montgomery Water Works system, with a mean of 0.76 ± 0.44 mg/L. Systems had concentrations near the EPA-recommended level of 0.7 mg/L for optimal caries prevention in children, though some approached the EPA secondary standard of 2.0 mg/L, a non-enforceable guideline intended to reduce cosmetic effects such as dental fluorosis rather than prevent systemic health effects. These findings show regional variability in water fluoridation practices and emphasize the need for routine monitoring to ensure safe and effective fluoride exposure for children. Understanding local fluoride concentrations supports informed choices for families and community discussions on fluoridation policies. Fluoride levels can be adjusted through changes in treatment protocols or source water, and continued monitoring with transparent public reporting is essential to promote trust in public water systems and reduce preventable oral health disparities.

Title: Urban bat biodiversity in a human-modified landscape

Primary Author: Anna Digges

Additional Authors: William Heintz;

Mentor: Jean Fantle-Lepczyk

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Bats are a highly diverse and quietly crucial part of ecosystem health, functioning as excellent insect control, which in turn benefits farmers, scientists, and the natural environment in which they live. However, the rapid loss of suitable habitat and increasing threat from disease have had devastating effects on the bat population in the United States, with as much as a 90% decline in several vulnerable species. The population of bats residing in the southeast United States appears to be faced with less critical levels of decline than other regions, although the reason is still largely unknown. One theory on the cause of this is the possibility of an increased usage of human structures rather than the more traditional caves for roosting. However, few population surveys have been conducted in the southeast, making it difficult to understand why they may be faring better. We aimed to increase our understanding of local bat populations through the deployment of SM4BAT FS Ultrasonic Recorders throughout urban areas around Auburn, AL. In several-week increments, these devices pick up the ultrasonic calls of bats in the form of .wav files, which can then be analyzed and identified to the species level. We also collected geospatial data on water sources, urban structures, and more to allow further analysis with species data collected. Preliminary data analysis has shown the presence of several bat species in locations in and surrounding Auburn, including the Auburn University campus. Early processing has shown the presence of the endangered Gray Bat and the proposed endangered Tri-colored Bat at locations on campus. With a more complete dataset, steps can be taken to further protect imperiled or at-risk species, supporting faltering populations in an urban landscape.

Title: Effects of microenvironment forces on migratory dynamics and morphology of immortalized GnRH cells

Primary Author: Anna Holliman

Additional Authors: Panagiotis Mistriotis; Ravi Sureshbhai Vaghasiya; Laci Mackay;

Mentor: Chad Foradori

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Gonadotropin releasing hormone (GnRH) cells are the central regulators of all vertebrate reproduction. GnRH cells develop outside of the central nervous system and must migrate into the brain for puberty and reproduction to occur. The pathway of GnRH cell migration traverses through distinct microenvironments including the nasal placode, cribriform plate, nasal forebrain junction, and the developing brain. We hypothesize that the physical interaction of GnRH cells with their unique migratory microenvironment results in alterations in cell morphology and physiology and is essential for proper cell maturation and function. To test our hypothesis, polydimethylsiloxane-based (PDMS) microfluidic devices were used to create tunable 3-dimensional spaces to model *in vivo* migration. GN11 cells were utilized as a model of immature, migratory GnRH cells. PDMS microfluidic devices were designed with parallel microchannels ranged from 10x10 mm², 6x10 mm², or 3x10 mm² (height x width) aligned in a ladder-like configuration connecting 2-dimensional seeding and collecting chambers. Migratory dynamics and morphological changes were determined over a 16-hour live cell imaging period. Migratory cells in microchannels had significantly more bipolar morphology compared to cells in 2-dimensional feeder channels. The bipolar morphology mirrors the presentation of migratory GnRH cells *in vivo*. Physical confinement decreased migratory speed of GnRH cells regardless of common chemotactic gradients and the presence of extracellular matrix proteins (collagen 1, collagen 4, fibronectin, or laminin). Overall, these findings suggest that when migrating in 3-dimensions, space restriction has the greatest effect on GN11 migration speed, more than even chemotactic or substrate signals. This ongoing project will develop and validate a new tool to study migrating GnRH cells in isolation, enhancing clinical relevance and translational impact of *in vitro* neural cell migration studies.

Title: Percolation modeling for CNT and GNP epoxy nanocomposites

Primary Author: Annalee Fink

Additional Authors:

Mentor: Suhasini Gururaja

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: The aerospace industry has seen an increase in the usage of carbon-based composites, as they offer a higher specific modulus of elasticity than conventional metals. A composite is a mixture of a reinforcing high modulus fiber material and a matrix, typically a low-modulus binder such as epoxy, with a visible fiber-matrix interface. Due to its low modulus, the matrix is often the weakest part of the composite. Therefore, a tertiary filler, often carbon nanotubes (CNT) and graphene nanoplatelets (GNP), is added to the matrix to enhance its strength. In addition, CNT and GNP fillers, at concentrations above a specific threshold, referred to as the percolation threshold, render the matrix electrically conductive. One method of testing composite performance is to measure the change in conductivity of a sample as a load is applied, with the sample acting as a strain gauge. Finding an optimal matrix-to-filler ratio is both expensive and time-consuming because CNTs and GNPs naturally clump together when mixed with epoxy. The research presented aims to reduce the burden of experimentation by developing a model to determine the percolation threshold for CNTs/GNPs in epoxy. Computer-generated 'digital composite samples' are created in 2D and 3D to ascertain if conductive paths are formed by calculating distances between fillers going from one side of the composite to the other. As a final step, these digital samples will be used to train a convolutional neural network (CNN) that will then help predict whether the percolation threshold has been reached for a real experimental sample.

Title: Characterization of endonuclease Bmrl-DNA complexes

Primary Author: Annaleisa Matzirakis

Additional Authors: Mohtadin Hashemi; Pedro Manuel Maximiano Santos;

Mentor: Mohtadin Hashemi

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Restriction endonucleases (REases) are indispensable components of the modern genetic engineering toolbox, as they play a crucial role in inducing precise cuts within DNA strands. One such enzyme, Bmrl, features several attractive properties from a bioengineering standpoint. In contrast to most other Type II REases, Bmrl does not require Mg^{2+} ions to become or remain functional/active, although is active in the presence of it. Secondly, isolation of Bmrl's catalytical N-terminal domain, via deletion of the C-terminal domain forming the Bmrl200 variant, retains its nuclease activity. Consequently, Bmrl200 is a very attractive enzyme from the standpoint of biological engineering as it can be attached to different C-termini in order to engineer novel REases. Despite the many interesting features of Bmrl, its structure and interaction with DNA are still largely unknown. We applied atomic force microscopy to directly visualize complexes formed by Bmrl protein interacting with DNA. We visualized complexes where the protein binds two segment of DNA, forming a loop. We also characterized DNA loops formed on substrates with Bmrl specific sites. In parallel, we utilized molecular modeling combined with molecular dynamics simulations to shed light on the structure of Bmrl and its complexes/interaction with DNA.

Title: Reimagining unconventional infrastructure as social and ecological connectors

Primary Author: Annie Neill

Additional Authors:

Mentor: Robert Sproull

Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: This research explores how unconventional infrastructure can be reimagined as adaptive social and ecological systems. Infrastructure is never neutral. Even the most utilitarian networks shape how people move, gather, and access opportunity. These underused thresholds contain latent capacity to function as civic and ecological connectors responsive to environmental conditions and the social contexts of surrounding communities. Rather than treating infrastructure as a fixed asset, this study interrogates how design can reposition these systems as frameworks capable of adapting to shifting climates and social needs. Situated near the Port of Mobile, Alabama, the project grounds its inquiry within a coastal infrastructural threshold where industrial, ecological, and civic systems intersect. The research employs three temporal phases: Conception, Mid-Life Crisis, and Afterlife, as an analytical lens to examine infrastructure life cycles and their evolving relationships over time. These phases structure a systems-based framework for ecological resilience and adaptive reuse, informed by precedent mapping, iterative design, and spatial and typological analysis. Through this lens, the project reveals parallels between infrastructural and social networks concerned with accessibility, food security, and environmental stewardship, emphasizing the reciprocal influence between infrastructure and the communities it serves. This study ultimately reframes infrastructure not as a static object, but as a living medium, both an archive and an active agent capable of recording transformation, sustaining community, and supporting shared ecological futures as landscapes and social conditions continue to evolve.

Title: Postharvest physicochemical changes in selected perfect-flowered muscadine (*Vitis rotundifolia*) cultivars during four-week cold storage

Primary Author: Apphia Santy

Additional Authors: Edgar Vinson; Marlee Trandel; Elina Coneva; FNU Jagjit Singh;

Mentor: Elina Coneva

Department/Program: Horticulture

College: College of Agriculture

Abstract: Muscadine grape postharvest performance can vary among cultivars due to differences in berry size, skin thickness, and composition, which influence water loss, firmness, and susceptibility to shriveling during storage. However, postharvest storage information for recently released perfect-flowered cultivars remains limited. In 2025, berries of the perfect-flowered cultivars Hall, Lane, Paulk, RubyCrisp, and Southern Home, and the pistillate cultivars Eudora and Supreme, were harvested from mature vines at the Chilton Research and Extension Center (CREC) in Clanton, Alabama, on 2 and 8 September. Fully ripe berries were packed in 1-lb vented clamshells containing 20 berries and stored at 4 ± 1 °C and $85 \pm 5\%$ relative humidity for up to 4 weeks, with quality evaluated at 0, 1, 3, and 4 weeks. Our results suggest that cultivar significantly affected all measured variables, while storage duration influenced berry weight, firmness, total soluble solids (TSS), titratable acidity (TA), and the percentage of shriveled or damaged berries; while juice pH and the TSS:TA ratio remained comparatively stable. Across cultivars, mean 20-berry weight declined from 218.6 g at harvest to 197.7 g by Week 4, and mean berry firmness decreased from 16.4 N to 11.2 N among cultivars that remained marketable. Mean berry TSS declined from 16.3 to 14.5 °Brix, while TA decreased slightly from 0.57% to 0.53%; juice pH remained constant at 3.5. Shriveled or damaged berries increased after 3 weeks of storage, with 'Southern Home' reaching 35% shriveling by Week 3 and 'Hall' and 'Lane' exhibiting 15–20% shriveling, resulting in loss of marketability before Week 4. In contrast, 'Paulk,' 'RubyCrisp,' 'Eudora,' and 'Supreme' maintained over 50% marketable berries through Week 4. Overall, these results demonstrate pronounced cultivar-dependent differences in postharvest deterioration and indicate that refrigerated storage can maintain acceptable quality for some muscadine cultivars for up to 4 weeks.

Title: Healthcare provider knowledge, attitudes, and perceived barriers regarding opioid harm reduction in older adults: A longitudinal survey study

Primary Author: Ariel Dulaney

Additional Authors: Lindsey Hohmann; Anne Taylor; Renee Delaney; Haley Phillippe;

Mentor: Lindsey Hohmann

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Opioid misuse continues to be a major public health issue in the United States. Older adults (≥ 65) are at particularly high risk of harm from opioids due to changes in opioid pharmacokinetics with age; however, healthcare professionals lack training and confidence in addressing opioid harm reduction strategies in this population. Therefore, the purpose of this study was to improve healthcare professional knowledge and beliefs regarding opioid harm reduction strategies amongst older adults. Healthcare professionals were recruited via email to attend an 8-hour interprofessional conference regarding opioid use/misuse in older adults. Changes in healthcare professional knowledge and beliefs before and after the conference were assessed via anonymous online surveys. Primary outcomes were measured using multiple-choice and Likert-type scale questions (1=strongly disagree, 5=strongly agree) and included: 1) knowledge of opioid use and misuse in older adults (5-items); 2) prescribing attitudes surrounding opioids and medications for opioid use disorder (MOUD) (5-items); 3) perceived susceptibility to harm from opioids (4-items); and 4) perceived barriers to opioid harm reduction in older adults (17-items). Changes from pre- to post-conference were analyzed using Wilcoxon signed-rank tests. Overall, mean (SD) knowledge (83.73% [19.92] versus 90.67% [12.45]; $p=0.011$) and perceived susceptibility (3.82 [0.63] versus 4.03 [0.63]; $p=0.002$) increased from pre- to post-conference, while perceived barriers decreased (2.71 [0.54] versus 2.54 [0.58]; $p=0.001$). Findings support the utility of interprofessional educational interventions to increase healthcare provider knowledge and beliefs regarding opioid harm reduction strategies amongst older adults.

Title: Effect of booster route on the efficacy of a live-modified Salmonella vaccine in broilers: impact on cecal colonization and organ prevalence

Primary Author: Arjmand Fatima

Additional Authors: Dianna Bourassa; Maria Baca Alaniz; Matthew Bailey; Jinquan Wang; Sabin Poudel; Muhammad Naeem;

Mentor: Dianna Bourassa

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Vaccination is a key pre-harvest strategy to reduce Salmonella contamination in broilers. This study evaluated the effect of a live-modified Salmonella vaccine under wild-type (WT) exposure, comparing two booster routes (spray vs. drinking water) on cecal colonization and organ prevalence (liver and spleen). Six hundred broilers were randomly assigned to three treatments: T1 (vaccine spray + water booster), T2 (vaccine spray + spray booster), and T3 (sham spray + sham booster [spray + water]). Cecal, liver, and spleen samples were aseptically collected on days 4, 28, and 35. Birds in all groups were orally challenged on day 10 with 10^6 CFU/bird of *S. Enteritidis*, but the challenge strain was not subsequently recovered. Thus, cecal counts and organ prevalence post-challenge reflect WT Salmonella. Cecal counts were log transformed and analyzed using one-way ANOVA and liver/spleen prevalence by chi-square in R ($P \leq 0.05$). On day 4, cecal $\log_{10}$ Salmonella counts did not differ among treatments (T1: 6.01 ± 0.33 ; T2: 6.36 ± 0.30 ; T3: 6.27 ± 0.29). Counts decreased across all treatments on day 28 and continued through day 35, with no significant differences among treatments. Liver Salmonella prevalence did not differ among treatments on day 4 (T1: 75%, T2: 62.5%, T3: 75%). By day 28, prevalence declined in T1 and T3 but remained stable in T2. On day 35, prevalence decreased in all treatments, with T1 significantly higher than T3 (T1: 37.5%, T2: 29.2%, T3: 4.2%; $P = 0.018$). No treatment-related differences were observed in spleen Salmonella prevalence on day 4 (T1: 75%, T2: 87.5, T3: 62.5%). On day 28, prevalence was higher in T1 than T3 (T1: 83.3%, T2: 62.5, T3: 41.7%; $P = 0.012$). By day 35, prevalence declined across all treatments, with no significant differences observed among treatments. Overall, WT Salmonella colonization declined with age and did not differ among treatments, indicating the need for a multi-hurdle approach for Salmonella control in poultry production.

Title: Mechanical characterization of 3D-printed interlaced flexible structures

Primary Author: Ashok Sapkota

Additional Authors: Sabit Adanur;

Mentor: Sabit Adanur

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Additively manufactured interlaced flexible structures enable single-step fabrication of customized architectures with potential applications in protective gear, wearable technology, and healthcare. The mechanical performance of these structures is strongly influenced by process parameters, making it essential to establish robust process–property relationships to understand their behavior. In addition, when deployed as functional components, these structures are subjected to impact and sustained loads, necessitating evaluation under dynamic and time-dependent conditions. This study investigates the mechanical behavior of FDM-printed interlaced flexible structures through two experimental approaches. In the first phase, the effects of extrusion temperature, layer thickness, and print speed on tensile and flexural properties are examined using a Taguchi L16 design of experiments. The results demonstrate that FDM processing conditions significantly influence the strength and stiffness of the printed components. The second phase focuses on dynamic and time-dependent loading. Impact response is characterized using a newly developed sound- and image-based method, as conventional Izod testing is unsuitable for flexible geometries. Furthermore, creep behavior is examined using multipolymer PLA-based blends, with experimental data employed to parameterize finite element creep models. The results highlight the combined roles of process parameters, interlaced architecture, and material composition in governing energy dissipation and long-term deformation. This work advances the development of high-performance, sustainably produced additively manufactured flexible structures and supports applications in functional textiles, soft robotics, protective equipment, biomedical devices, wearable electronics, and advanced filtration systems. We as a research group, based on current findings, are moving towards developing functional flexible parts using additive manufacturing.

Title: Factors Influencing the MASLD Risk in Type 2 Diabetes: A cross-sectional study

Primary Author: Asmita Priyadarshini Khatiwada

Additional Authors: Surachat Ngorsuraches;

Mentor: Surachat Ngorsuraches

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Considering the burden of metabolic dysfunction-associated steatotic liver disease (MASLD) in individuals with type 2 diabetes (T2D), this study aimed to identify factors associated with MASLD among adults with T2D from 2021 to 2023. A retrospective cross-sectional study using data from the 'All of Us' NIH research program was conducted. MASLD was identified using ICD-9/10 and SNOMED codes. Various factors, including age, gender, race/ethnicity, health insurance, education, employment, household income, comorbidity burden measured by the Charlson Comorbidity Index (CCI), and social determinants of health (SDOH), such as deprivation index by zip code, food insecurity, housing instability, social cohesion, neighbourhood disorder, and others, were examined. Descriptive and multiple logistic regression analyses (with adjusted odds ratios, aORs) were conducted. A significance level of 0.05 was considered. Among 26,246 T2D patients identified (average age: 63.3 years), 8.2% had a recorded diagnosis of MASLD. Most patients were female (56.4%) and non-Hispanic White (65.3%). Approximately 53% had less than a college education, 39% had an annual household income of <\$50k and 38% had a high comorbidity burden ($CCI \geq 3$). About 23% reported food insecurity, with an average deprivation index of 0.3. Patients with $CCI \geq 3$ (vs. $CCI < 3$, aOR: 2.15), females (vs. males, aOR: 1.29), and those with less than a college education (vs. a college education and higher, aOR: 1.21) significantly had higher odds of MASLD, while patients who are retired (vs. employed, aOR: 0.77), older individuals (aOR: 0.98), and non-Hispanic Blacks (vs. non-Hispanic Whites, aOR: 0.48) significantly had lower odds of MASLD. None of the SDOH considered in this study was significant. In conclusion, MASLD in T2D was more strongly associated with sociodemographic and comorbidity burden than with SDOH factors. Future work needs to examine whether broader social and structural factors contribute to the risk of MASLD.

Title: Studying street tree planting for pedestrian heat mitigation using lidar-based mean radiant temperature modeling

Primary Author: Asmita Regmi

Additional Authors: Luyu Liu;Georgios Arseniou;

Mentor: Georgios Arseniou

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Pedestrians in urban areas are increasingly exposed to extreme heat due to climate change and urbanization, generally along streets and sidewalks with limited shade. Conventional urban heat assessments often depend on area-based or surface temperature indicators, which poorly represent thermal conditions experienced within pedestrian walking environments. While recent studies emphasize pedestrian-scale heat exposure and the cooling role of urban vegetation, few provide spatially explicit frameworks to support street-tree planting decisions. This research proposes a GIS-based framework to prioritize plantation zones for reducing pedestrian heat exposure in Alabama using Mean Radiant Temperature (T_{mrt}) as the primary thermal indicator. Airborne LiDAR point cloud data will be used to derive three-dimensional urban form characteristics, including building geometry and tree canopy structure. Pedestrian-level T_{mrt} will be modeled at fine spatial resolution using Solar and LongWave Environmental Irradiance Geometry model (SOLWEIG) and aggregated to sidewalk and street-walk segments to reflect pedestrian walking environments. Based on these results, a tree planting prioritization framework and alternative planting scenarios will be evaluated to quantify potential reductions in pedestrian heat exposure. Recently planted tree locations will be assessed to examine their alignment with identified heat-priority areas. This study aims to support climate-responsive urban greening and pedestrian-oriented heat mitigation. The results will include sidewalk-level mean radiant temperature maps, estimates of cooling potential from alternative tree-planting scenarios, and a spatial prioritization framework to guide pedestrian-oriented heat mitigation.

Title: Integration of organic amendments and plant growth-promoting rhizobacteria to enhance drought resilience in cotton production

Primary Author: Aththotage Don Sachini Piumika Ariyachandra

Additional Authors: Kathy Lawrence;Bisho Lawaju;Rishi Prasad;Debolina Chakraborty;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Drought is a major constraint to cotton (*Gossypium hirsutum* L.) production, severely limiting yield and fiber quality in many cotton-growing regions worldwide. The United States is a major contributor to global cotton production, with most cotton cultivated in the southern-tier states, areas particularly susceptible to drought stress. Plant Growth Promoting Rhizobacteria (PGPR), have emerged as promising beneficial microbes in enhancing plant drought resilience and N fixation. Broiler litter, as a rich source of Carbon (C) and Nitrogen (N), can serve as an alternative to synthetic fertilizers and as an enhancer of soil biological activity. Therefore, this study aimed to evaluate the ability of PGPR integrated with broiler litter to enhance the drought resilience of cotton plants. A 55-day greenhouse experiment was conducted in a complete randomized design with nine pre-selected drought-resistant PGPR strains across three irrigation regimes (100%, 70%, and 40% of Field capacity), replicated four times. Broiler litter was added as the nutrient source. Plant parameters, including aboveground and belowground biomass, were measured at harvest. Results demonstrated that PGPR strains significantly enhanced cotton growth under poultry litter fertilization ($p < 0.05$). Biomass responses further supported these trends: biomass was significantly reduced under water stress, yet some PGPR strains produced greater above- and below-ground biomass than the control. Overall, integrating poultry litter with drought-tolerant PGPR improved cotton physiological performance under drought.

Title: The influence of listening effort and mental workload in an aviator's cockpit: A systematic review

Primary Author: Audrey Cordier

Additional Authors: Sridhar Krishnamurti;

Mentor: Sridhar Krishnamurti

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Piloting is a hazardous occupation that is confounded by high human factor demand and pilot error. According to the National Transportation and Safety Board, approximately 70% of aviation accidents can be attributed to pilot error. Compared with mechanical error (17.3%) and other, such as weather (13.7%), mistakes made by aviators are the leading contributor to accidents in the aviation field. Despite these startling statistics, the roles of significant human factors, specifically mental workload and listening effort, have been addressed relatively little in pilots. The purpose of this study is to perform a systematic review analyzing the role of mental workload and listening effort in a pilot's cockpit. An exhaustive search in APA PsycInfo, Ei Compendex, Ovid, and Web of Science (databases) was conducted, producing 103 articles. We calculated Cohen's d (effect size) for these articles and included those that had middle to high effect size. Results revealed that listening effort was increased by number of radios, number of auditory alerts, and hearing loss. The modern cockpit often requires pilots to simultaneously monitor many radio frequencies, Air Traffic Control reports, and various auditory alerts, all requiring a response. Hearing loss can further increase listening effort that exceeds the pilot's capability. As a result, it can hinder the capacity of mental workload, which was primarily influenced by attention span, inattentive deafness, and working memory. A pilot's attention becomes divided with increasing number of alarms, which causes the pilot to miss, or become deaf to these signals. As working memory load increases, the possibility of distractions interfering with pilot function also increases. These results support the value of proper selection, training, and workload management in aviators. Future research to improve these factors can decrease accidents in aviation by decreasing effort and workload, creating a safer environment for aviators.

Title: A systematic review of auditory and cognitive function post-COVID: the effects of age, time, training, & technology

Primary Author: Audrey Headrick

Additional Authors:

Mentor: Sridhar Krishnamurti

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Hearing loss and cognitive decline are major public-health challenges for aging Americans, with prevalence rising due to population aging and multimorbidity. These burdens have intensified post-COVID, as prolonged social isolation and reduced auditory-cognitive stimulation have been linked to accelerated decline among vulnerable older adults. This systematic review examines auditory and cognitive function in adults aged ≥ 60 , focusing on age, temporal factors, training interventions, and hearing technology. A PubMed search of studies published January 2020–February 2026 using terms related to aging, auditory function, cognitive decline, training, amplification, and neuroplasticity yielded 2,009 records. Following screening and full-text review, 14 studies met inclusion criteria, including experimental, longitudinal, and systematic review designs reporting measurable auditory and/or cognitive outcomes. Findings clustered across four domains. Age and participant characteristics moderated outcomes, with older adults and those with mild-to-moderate deficits benefiting most. Training interventions, including structured auditory-cognitive and speech-in-noise programs, showed small-to-moderate improvements in speech perception and selected cognitive measures in most studies (≈ 10). Evidence from four studies indicated that hearing technology, including hearing aids and cochlear implants, enhanced auditory-cognitive outcomes. Temporal factors, including training duration and dosage, further influenced improvement magnitude. Overall, evidence suggests that age, intervention intensity, and amplification access are key determinants of auditory and cognitive outcomes post-COVID. These findings support early intervention, structured auditory-cognitive training, and improved access to hearing technology to mitigate age-related decline in older adults.

Title: Distribution of AAV Gene Therapy in GM1 Gangliosidosis-Affected Cats

Primary Author: Audrey Miller

Additional Authors: Amanda Gross;

Mentor: Amanda Gross

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: GM1 gangliosidosis (GM1) is a neurodegenerative disease caused by a dysfunction of the GLB1 gene. Affected individual's cells cannot produce $\beta\beta$ -galactosidase (Bgal), which is responsible for the lysosomal destruction of GM1 ganglioside. While GM1 ganglioside is a crucial molecule in a healthy organism, without break-down, it builds to fatal levels. This disease affects primarily the brain in both humans and cats, so cats are used as a model. To treat GM1, an adeno associated virus (AAV) was used to deliver a functional copy of the GLB1 gene to affected cats via injection. Specifically, AAV9 was used, due to its ability to permeate the blood-brain barrier. This study examines the use of both a central and a periphery injection site in order to increase distribution, with qPCR techniques being used to look for the presence of the DNA from the AAV in the tissues of the treated cats. Overall, treatment has been successful, as it improved the quality and length of life for the treated cats.

Title: Mitigating against the Propagation of Tin Whiskers in Mission Critical Applications

Primary Author: Austin Evans

Additional Authors: Emily Grady; Drew Goodhope; Sarah Prince;

Mentor: George Flowers

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: As electronic solder and platings age and experience harsh environmental conditions, they exhibit a phenomenon known as whisker formation. Whisker formation can occur in a wide variety of solder chemistries, with unleaded solders being especially prone. Many notable electronic failures have been attributed to whisker-related electrical shorts. As the electronic industry transitions to unleaded solders due to globally influenced health and supply chain pressures, a greater emphasis has been placed on designing and testing unleaded solder mitigation methods that delay or reduce whisker formation. Many of these mitigation methods have been tested and implemented to combat tin whisker formation mechanisms in a variety of ways. Tin whisker formation testing standards exist, however, the need for harsh-environment application-based mitigation guidelines is still needed. The proposed framework includes component function analysis, environmental assessment, acceptable risk determination and design specific evaluation intended to assist professionals with selection and sequencing of appropriate solder and plating parameters and other mitigation strategies. This framework is structured in a chronological decision-making format to allow designers to tailor mitigation strategies to their design's specific needs rather than provide a generic, one size fits all solution.

Title: Fasting-Associated Changes in Gut Morphology and Immune Response in *Mus musculus*.

Primary Author: Ava Murren

Additional Authors: Wendy Hood;Lauren Cacciatore;Rex Usry;

Mentor: Wendy Hood

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Over the past decade, intermittent fasting (IF) has gained popularity as a dietary intervention associated with metabolic and immunological benefits, including weight management, enhanced gut immunity, and reduced inflammation. Despite these proposed benefits, the long-term effects of fasting on gut morphology and immunity remain largely uncharacterized due to the inherent plasticity of the gut and immune system. For this study, wild-derived house mice (*Mus musculus*) were subjected to three different fasting regimens for two weeks: 24-h feeding/24-h fasting, 36-h feeding/36-h fasting, or ad lib (control). Following this, the intestines were resected, and 1-cm sections from the duodenum, jejunum, and ileum were collected, paraffin-embedded, stained with hematoxylin and eosin and sectioned. Gross measurements, including total intestinal length and width, segment-specific dimensions, body weight, and additional organ masses were recorded at the time of processing. Histological analyses quantified villus length, width, and density, goblet cell number, and the number and relative size of Peyer's patches. We hypothesized that there would be a significant difference in the gross measurements and histological data corresponding to the intensity of fasting. We predicted an increase in intestinal length in the 24-h group relative to the control and a decrease in the 36-h group, and an increase in villi measurements in the 24-h group and a decrease in the 36-h group. Preliminary analysis of villus length, width, and density between the sample groups revealed no significant differences; however, more analysis is yet to be done. With just the preliminary analysis, we attribute this non-significance to the inherent plasticity of the gut. Ongoing analyses will seek to further evaluate metabolic and immunological measures, including Peyer's patches size and distribution, goblet cell distribution, liver mass, and body weight, to more fully characterize fasting-induced adaptations.

Title: Meta-analytic review of the neurometabolic makeup of the anterior cingulate cortex (ACC) in major depressive disorder (MDD)

Primary Author: Ava White

Additional Authors: Alan Wilson;Meredith Reid;

Mentor: Jennifer Robinson

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Major Depressive Disorder (MDD) has placed a detrimental burden on society, but the heterogeneous nature of the disorder makes it difficult to delineate its neurological markers and slowed research progress. Some research on the neural correlates of MDD focus on the anterior cingulate cortex (ACC), a limbic system region associated with the generation of depressive symptoms. The purpose of this study is to assess concentrations of neurometabolites in the ACC of people with MDD compared to healthy controls by conducting a systematic review and meta-analysis. A literature search was conducted across four databases for magnetic resonance spectroscopy (MRS) studies on this topic, with eligibility dependent on a priori-defined criteria. Data for metabolic concentrations of eight key neurometabolites were extracted, and effect sizes were quantified using standardized mean differences (Hedges' g) and pooled using a random effects model. The initial database search yielded 1,666 studies, and after removal of duplicates and a full screening process, 43 studies were eligible for meta-analysis. Results suggested that individuals with MDD had significantly decreased levels of N-acetylaspartate (NAA; $p = 0.017$) and GABA ($p = 0.004$), and significantly increased levels of glutamine (Gln; $p < .001$) in the ACC compared to controls. Additionally, NAA was moderated by MRI magnet strength, glutamine (Gln) was moderated by ACC subregion, and myo-inositol and choline were moderated by medication status. Decreases in NAA could suggest deficits in neuronal health and density in the ACC associated with MDD, and decreases in GABA are consistent with a well-established GABAergic deficit hypothesis of MDD. Increased Gln highlights several potential alterations in the glutamate/glutamine cycle and astrocytic functioning. Altogether, this study supports multifaceted alterations in ACC neurometabolism associated with MDD that could inform biomarker identification and treatment development.

Title: The Study of the Prevalence and Evolution of US Election Fraud

Primary Author: Avery Hillman

Additional Authors:

Mentor: Mitchell Brown

Department/Program: Political Science

College: College of Liberal Arts

Abstract: The purpose of this study is to measure the prevalence and evolution of US election fraud by determining if there is a significant amount of fraud in comparison to the number of elections run across the country in a four-year cycle. This is important due to the negative portrayal of elections and administrators in the media. Voter fraud is typically considered illegally altering votes. For the purpose of this study, I will be discussing voter fraud in 5 contexts, which are: impersonation at the polls, false registrations/duplicate voting, ineligible voting, fraudulent use of absentees, ballot petition fraud. In my data collection period, I closely examined three states and their voter fraud issues, including the five types of voter fraud previously established. I looked at one solid Republican, solid Democrat, and swing state and inside those states looked at a small, medium sized, and large population county relative to the states. I collected data on voter fraud across all fifty states, and conducted personal interviews with various election officials and officeholders. Following the completion of my research by the Symposium in March, I hope to provide a basis for these rising concerns of fraud and an answer to if they are valid or not with relevant data.

Title: From diagnosis to dynamic personalized intervention: Transforming dementia healthcare through integrating pharmacogenomics, AI, and multimodal data

Primary Author: Ayat Trish

Additional Authors: Keyi Liu;Suhrud Pathak;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: Dementia comprises a heterogeneous group of disorders, including Alzheimer's disease, vascular dementia, Lewy body dementia, and frontotemporal dementia, characterized by substantial variability in clinical presentation, disease progression, and treatment response. Conventional, standardized care pathways often fail to accommodate this complexity. Personalized management strategies that integrate pharmacological, cognitive, and lifestyle interventions with an individual's genetic profile, comorbidities, symptoms, and functional status offer a more precise and effective approach. Although artificial intelligence (AI) has improved diagnostic imaging and risk prediction, the integration of multimodal data with pharmacogenomics into dynamic, individualized models for longitudinal dementia management remains limited. AI-driven analysis of neuroimaging, genomic and pharmacogenomic data, clinical assessments, and digital biomarkers has the potential to enhance early and differential diagnosis, predict disease trajectories, and optimize personalized therapeutic strategies. This study develops and evaluates an AI-enabled framework that integrates multimodal datasets using machine-learning algorithms to identify diagnostic patterns, forecast progression, and generate individualized intervention plans. Continuous data streams support real-time refinement of treatment strategies and medication selection. The findings demonstrate improved diagnostic accuracy, earlier differentiation among dementia subtypes, enhanced progression prediction, and optimized treatment recommendations. Incorporation of pharmacogenomic insights enables more precise drug selection and dosing while minimizing adverse effects, supporting a shift from static protocols to adaptive, patient-centered dementia care.

Title: Assessing and characterizing resistance to Cotton Leaf Roll Dwarf Virus (CLRDV) and *Aphis gossypii* in Cotton Genotypes

Primary Author: Ayodele Amodu

Additional Authors: Jenny Koebernick;Giovani Rossi;Alana Jacobson;

Mentor: Jenny Koebernick

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Eight years after the first report of cotton leaf roll dwarf virus (CLRDV; family Solemoviridae, genus Polerovirus) in the U.S., it has been detected across the Cotton Belt but has only been associated with yield loss in Alabama and Georgia. Although not currently considered to be a major economic problem, CLRDV remains a looming epidemiological risk that could intensify rapidly given suitable environmental conditions. CLRDV can reach up to 100% incidence in some areas, and viruses can evolve to cause more severe disease over time. The most effective way to manage viral diseases is by growing resistant varieties. The destructive potential of CLRDV is further exacerbated by the lack of effective control methods and the susceptibility of all commercial cultivars. *Aphis gossypii* is the only confirmed vector of CLRDV, although several other aphid species feed on cotton in Alabama. While the seasonal dynamics of *A. gossypii* in cotton fields and the associated factors have been well documented, the factors influencing insect pressure on individual cotton genotypes and how this may affect resistance to CLRDV remain unclear. This study assesses the resistance of cotton genotypes to CLRDV and the vector using cumulative insect days, and both leaf gossypol and sugar content as indirect indicators of plant-level resistance. We hypothesize that lower cumulative insect days, higher gossypol, and lower sugar content will correlate positively with cultivar resistance. Natural aphid infestation was monitored on 386 cotton genotypes during the peak infestation window between June and July 2025, and leaf samples were collected and lyophilized for future analysis of gossypol and sugar content. Based on their cumulative insect days in the field, cultivars were grouped into resistant and susceptible categories, and selected cultivars were further evaluated for CLRDV resistance under controlled settings. A potential source of resistance to US-CLRDV was identified, and future steps to characterize this resistance are outlined.

Title: Performance-related configuration patterns in Infrastructure as Code

Primary Author: Balapuwaduge Mendis

Additional Authors:

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Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Infrastructure as Code (IaC) is the practice of automatically configuring, managing, and provisioning an organization's infrastructure using configuration scripts. Despite their benefits for automated software deployment and configuration management, configuration scripts can incur performance overhead with respect to execution time and memory consumption. The systematic derivation of performance-related configuration patterns can aid practitioners in reducing performance overhead when using configuration scripts for IT automation tasks. Performance-related configuration patterns are recurring coding patterns in configuration scripts that are associated with performance overhead. We conduct an empirical study with 4,523 Ansible configuration scripts obtained from 72 open source software (OSS) projects and 64 configuration scripts obtained from two proprietary repositories used by Org.-Z. We derive a list of five performance anti-patterns in Ansible configuration scripts that negatively impact performance. Additionally, we develop a static analysis tool, called PERFector, that detects these patterns in configuration scripts. Using this tool, we identify the 'needless facts' pattern to be the most frequent performance anti-pattern. Furthermore, we provide recommendations for practitioners on how to use our findings for their configuration script development process.

Title: Enhancing honey bee IPM through citizen science: assessing nationwide spatial and temporal trends in winter brood

Primary Author: Benedict DeMoras

Additional Authors: Stephanie Rogers;Ashtyn Gluck;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Honey bees contribute an estimated \$34 billion to agricultural pollination, yet beekeepers in the United States face unsustainable colony losses (56% annually in 2024-2025) driven by the parasitic mite *Varroa destructor*. Several miticide treatments exist, but they cannot penetrate the wax cappings that protect mites feeding on honey bee brood. This challenge is compounded by the potential introduction of another parasitic mite, *Tropilaelaps mercedesae*, due to its obligatory reliance on capped brood. While oxalic acid is an effective miticide during winter broodless periods, few beekeepers inspect colonies to confirm these treatment windows. To address this, we launched a citizen science initiative to map winter brood across the U.S. by distributing beekeeper surveys via social media and leading industry publications. During three observation windows between December 19, 2025, and January 18, 2026, participants conducted brief, minimally invasive inspections of up to three colonies each to verify the presence or absence of brood. This initiative engaged over 200 beekeepers in integrated pest management (IPM) decision-making by encouraging mite treatment decisions based on real-time inspection results. We found the proportion of colonies containing brood rose from 57% at the beginning of the first inspection window, to 71% by the second window, and 80% by the end of the third window. Our results demonstrate temporal and spatial variation in winter brood rearing across the U.S. These data will be used to develop predictive models that inform optimal miticide treatment timings based on apiary location, improve resilience against *Varroa*, and prepare for the looming threat of *Tropilaelaps*.

Title: Multicomponent diffusion coefficients for alcohol–water mixtures simulated using the OPLS force field with OPC water.

Primary Author: Benjamin Forson

Additional Authors: Michael Howard; Noah Frison; Brennan Hall;

Mentor: Michael Howard

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Multicomponent diffusion is a complex transport process in which a concentration gradient of one component can drive a flux of another, and these cross-component interactions can play a crucial role in membrane-based separations. In this work, we performed atomistic molecular dynamics simulations of binary and ternary mixtures of methanol, ethanol, and n-propanol in water to make progress toward understanding multicomponent separations for carbon-dioxide reduction products. We used the OPLS force field to model the different alcohols and the OPC force field to model water, and we extracted the molar volume and volume of mixing from isothermal-isobaric simulations; the Onsager, Maxwell–Stefan, and Fick multicomponent diffusion coefficients from isothermal–isochoric simulations; and the shear viscosity from nonequilibrium shear-flow simulations. The extracted properties of the binary mixtures were compared to experimental data to assess the performance of the chosen force field. Our work provides useful reference data for multicomponent diffusion coefficients as a function of composition, especially for ternary mixtures for which experimental data is more sparse.

Title: Testing Aldo Leopold's hypothesis of red fox and domestic cat coexistence

Primary Author: Benjamin Harrell

Additional Authors: Christopher Lepczyk; Jean Fantle-Lepczyk;

Mentor: Christopher Lepczyk

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Competition between red foxes (*Vulpes vulpes*) and domestic cats (*Felis catus*) has long been noted, and Aldo Leopold in 1929 even hypothesized that where red foxes were present, cats would not be found. This hypothesis is inherently difficult to answer at a large scale, and there is little to no evidence in the literature that gives a definitive answer. As urban areas continue to encroach on wild areas, it is important to understand how domestic cats impact the landscape. If red foxes do exclude domestic cats from occupying certain areas or niches, it could be a useful piece of information used by managers to limit domestic cats' access to some parts of the environment. We tested this hypothesis using data from the Snapshot USA database, which is a nationwide collaborative project that uses camera traps to survey mammals. We used data from 267 camera arrays spanning 2019 to 2024 from within the contiguous United States, across which both red foxes and cats are found. Initial analysis of the data at the array level over the six study years showed that 53% of camera arrays contained cat or red fox data. Of the arrays that featured either a cat or red fox, 39% contained both species suggesting that they do not exclude each other at a significant level at this spatial scale. However, when we looked at the camera level, we found that red foxes and domestic cats either exhibited temporal partitioning in areas of overlap or excluded each other completely as only 17% of cameras showcased coexistence. The next step in the research is to conduct a formal occupancy analysis. These findings will help direct future research on species occupancy using camera trap data and inform wildlife managers of the ecological role of domestic cats and red foxes as urban areas expand.

Title: Perceived effectiveness of academic accommodations among students with cochlear implants

Primary Author: Benjamin Smith

Additional Authors: Alisha Jones;

Mentor: Alisha Jones

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Students with cochlear implants (CIs) often require academic accommodations to support access to instruction in K–12 educational settings. These accommodations are typically determined early in a student’s academic career and may evolve as academic demands, classroom formats, and communication needs change across grade levels. However, limited research has examined which accommodations are perceived as most effective by CI users themselves, particularly across different instructional contexts. This study investigated the types of academic accommodations used by students with cochlear implants during grade school and their perceived helpfulness during lectures, classroom discussions, and group-based learning. Nineteen individuals who used cochlear implants during K–12 education completed an online survey regarding accommodation use, American Sign Language (ASL) proficiency, and perceived effectiveness of academic supports. Results indicated that preferential seating and closed captioning were the most frequently used accommodations and were consistently rated as very helpful, particularly during teacher-led instruction. FM systems, copies of teacher notes, and extended time were also commonly used and perceived as beneficial. Although most participants reported little to no ASL proficiency, those who were proficient rated ASL interpreter services favorably. Across accommodations, perceived effectiveness decreased in group-based learning environments, suggesting persistent communication challenges during collaborative activities. These findings underscore the need for individualized and flexible accommodation planning, increased awareness of available supports, and continued research to inform educational practices and state- and national-level policies that better support students with cochlear implants across diverse classroom settings.

Title: Interacting while driving task analysis of 5 currently available vehicles

Primary Author: Benjamin Tankersley

Additional Authors: Missie Smith;

Mentor: Missie Smith

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: Distracted driving remains a critical behavioral safety issue contributing to roadway accidents. Auburn University, in collaboration with Toyota's Collaborative Safety Research Center, is conducting research to quantify the behavioral risks associated with modern in-vehicle interfaces. The purpose of this research was to understand how the interaction model (cognitive and visual demands of the in-vehicle interface that may precipitate driver error) might impact the specific cognitive and physical demands placed on the driver and resulting driver distraction. This work lays the foundation for a systematic methodology to map the specific behavioral demands placed on the driver by the in-vehicle interface. This approach allows us to contrast interactions to determine which designs best support safe driving behaviors and identify which design characteristics may promote unsafe driver behaviors. We selected the vehicles by targeting various interaction models (mostly buttons, mostly touchscreen, and combinations thereof). In this detailed task analysis, we collected information about how drivers input information into the in-vehicle center console, the types of feedback that they receive from the vehicle, and the individual steps required to complete each task. We conducted a qualitative and quantitative analysis comparing the five vehicles. From this data set, we drew conclusions about the implications of this work for the design of new in-vehicle information systems that encourage safe driver behaviors by minimizing distraction. This work will support future research that will ultimately offer data-driven recommendations for behavioral safety interventions and system designs intended to minimize voluntary and involuntary driver distraction.

Title: Numerical simulations of ultrafast transient heat conduction at nanoscale

Primary Author: Benjamin Tzou

Additional Authors:

Mentor: Jianjun Dong

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: At nanometer length scales and ultrafast time scales, heat transport departs from the classical Fourier law due to memory effects and spatial nonlocality. Under these conditions, heat no longer diffuses instantaneously but can exhibit a range of non-Fourier behaviors, including wave-like thermal propagation. As a result, traditional diffusion-based models become inadequate for describing heat flow in nanoscale materials and devices subjected to localized, transient heating. In this work, we present a computational framework based on the Zwanzig heat-conduction kernel formalism, which establishes a new paradigm for connecting atomistic-scale calculations with continuum-level thermal simulations. Unlike phenomenological non-Fourier constitutive models, the Zwanzig approach provides a physically grounded description of heat-flux evolution by explicitly incorporating temporal memory and spatial nonlocal length scales that arise from microscopic dynamics. We develop a two-dimensional polar implementation of the Zwanzig formalism to model radially symmetric heating conditions relevant to laser-based experiments. The solver captures transient heat-flux dynamics, radial divergence effects, and Gaussian heat sources. Algorithmic restructuring and parallelization enable simulations over experimentally relevant spatial and temporal scales, allowing systematic analysis of spatial nonlocality effects. As an application, we investigate wave-like second-sound heat transport in silicon membranes, highlighting the interplay between memory time scales and nonlocal length scales in shaping thermal propagation. Beyond fundamental insight, this framework provides guidance for nanoscale thermal management, with implications for controlling heat dissipation in next-generation, high-power-density technologies such as advanced AI and machine-learning chips.

Title: Development of a qPCR assay for the quantification of *Paenibacillus riograndensis* DH44

Primary Author: Bibek Dabargainya

Additional Authors: Zachary Noel;

Mentor: Zachary Noel

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: *Paenibacillus reograndensis* is a plant growth-promoting bacterium (PGPB) that serves as a potential bio-stimulant alternative to synthetic N fertilizers, and utilizing this bacterium may help reduce associated costs. However, tools to identify and quantify them must be developed to validate their effects and compare them with N fertilizers in field scenarios. Here, we attempted to develop a strain-specific quantitative PCR (qPCR) assay to identify and quantify DH44, a strain previously shown to be beneficial to turfgrass forage systems. A comparative genomic analysis of DH44 against 1122 *Paenibacillus* genomes using K-mers Exclusion by Cross-referencing (KEC) yielded 59 unique regions, from which ten primer pairs were designed, ranging from 105 to 176 bp in length. The qPCR assays performed with these primer pairs were optimized to refine primer concentrations and thermal cycling conditions. Primer pairs KEC 12 and KEC 13 emerged as the most robust primers with 99.4% and 90.08% primer efficiency, respectively. The limit of detection (LOD) was obtained at 0.1 pg DNA, equivalent to approximately 124 DNA copies, ensuring high assay sensitivity. Additionally, in-plant validation against CFU counts in KY32 tall fescue grass revealed similar trends, with higher sensitivity by qPCR, indicating that the assay is suitable for tracking DH44. In the future, this approach may also serve as a generalizable framework for rapid development of detection tools for a wide range of microorganisms, supporting population tracking efforts across multiple disciplines beyond agriculture.

Title: Competing Interfacial and Buoyancy Controls on PCM Melting: Trapped Air Layers and Inclination Effects in n-Eicosane

Primary Author: Bikram Bhattarai

Additional Authors: Jay Khodadadi;

Mentor: Jay Khodadadi

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Buoyancy-driven melting in latent-heat thermal storage can be strongly altered by unavoidable trapped gas layers and by system orientation. We numerically study melting of n-eicosane in a 2D square cavity (40 mm $\times$ 40 mm) with the left wall held at 370 K and the remaining walls adiabatic, starting from 298 K. An immiscible air layer is placed adjacent to the heated wall with thickness $\delta_{\text{air}} \in \{0, 0.25, 0.5, 1, 2\}$ mm, and the cavity is inclined by $\theta \in \{0^\circ, 10^\circ, 20^\circ\}$. The air–eicosane interface is resolved using VOF, while phase change in eicosane is modeled using the enthalpy–porosity method with laminar flow and buoyancy enabled. Melting is quantified using the time history of global liquid fraction for all 15 cases. The Liquid fraction data show a clear two-stage response. First, melt initiation is strongly controlled by the air layer: the time to reach $LF = 0.01$ increases from 3.77 s ($\delta_{\text{air}} = 0$) to 36.7 s ($\delta_{\text{air}} = 2$ mm), i.e., $\sim 10\times$ delay. Second, once a sustained melt region forms and buoyancy transport develops, curves partially collapse and the influence of δ_{air} on completion becomes weak (full-melt time variations within $\approx \pm 40$ s, $\leq \sim 2\%$). In contrast, inclination provides a robust acceleration across all δ_{air} : the time to full melting ($LF = 1$) decreases from 2706–2744 s at $\theta = 0^\circ$ to 2233–2273 s at $\theta = 10^\circ$ (≈ 16 – 18% faster) and 2040–2074 s at $\theta = 20^\circ$ (≈ 24 – 25% faster). These results indicate that trapped air primarily adds early-time thermal resistance, whereas inclination enhances buoyancy-driven circulation and global heat redistribution, substantially shortening late-stage melting.

Title: Imagining parenthood: How attachment and risky childhood experience shape parenting attitudes and expectations

Primary Author: Blakely Berryhill

Additional Authors: Jennifer Somers;

Mentor: Jennifer Somers

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Negative expectations of parenthood and exposure to risky childhood experiences can affect subsequent parenting behaviors. However, secure attachment styles with romantic partners later in adulthood may buffer against the potential adverse effects of earlier adversity on parenting attitudes and expectations. This study investigated how childhood family experiences, adult attachment style, and their interaction influence parenting attitudes and expectations (PAE) in the preconception period. We hypothesized that adults who faced a riskier family environment, but had a secure attachment style, would report more sensitive PAE compared to adults who had an insecure attachment style. To test these hypotheses, we assessed early caregiving experiences, adult romantic attachment, and self-reported PAE among 142 nonparental adults (Mage = 19.8 years, 79.5% female). Participants reported on their early childhood experiences using the Risky Families Questionnaire, adult attachment in their romantic relationship using the Experiences in Close Relationship Scale-Short Form (ECR-S), and PAE using the Early Parenting Attitudes Questionnaire (EPAQ) and an adapted version of the Prenatal Maternal Expectations Scale (PMES). Hypotheses were evaluated through a series of linear regressions. Risky childhood experiences did not predict PAE, all p 's > .05. Attachment anxiety was a marginally significant predictor of affection and attachment, $\beta = -.240$, $p = .11$, such that anxiously attached adults have less sensitive PAE. Attachment anxiety did not predict the other parenting outcomes, all p 's > .10. The interaction between risky childhood experiences and attachment anxiety was also not a significant predictor of PAE, all p 's > 0.10. Even accounting for early caregiving experience, current romantic relationship quality may powerfully shape PAE. Early prevention for sensitive parenting should focus on promoting secure relationships with partners prior to conception.

Title: Neurophysiological affective reactivity classification and its stability in individuals with Cannabis Use Disorder

Primary Author: Brandon Schermitzler

Additional Authors: Thomas Preston;Clarisse Nacilla;

Mentor: Samantha Fede

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: The incentive salience model of addiction posits that drug-related stimuli become more motivationally relevant relative to natural reinforcers (e.g., food, adventure, romance) as addiction progresses. A neural measure of motivational relevance, the late positive potential (LPP), has been used to classify individuals into groups differing in motivational salience of drug vs. natural reinforcers. The present study aims to replicate these findings in a sample of individuals with Cannabis Use Disorder (CUD) and assess the stability of this classification. Individuals with moderate or severe CUD (N = 44) ages 18-50 viewed sets of neutral (N), pleasant (P), unpleasant (U), and cannabis (C) images during concurrent EEG recording at two visits over a one-week period. The resulting LPP amplitudes for each picture type at each visit were entered into a k-means cluster analysis. Results showed a picture type effect in the expected pattern (C and P > N), $F(3,121.55) = 25.64$, $p < 0.001$. The k-means cluster analysis resulted in the two expected clusters at each lab visit, with 22 and 20 individuals, at each lab visit respectively, assigned to a cluster with higher reactivity to C compared to P and 19 and 20 individuals, respectively, assigned to a cluster with higher reactivity to P compared to C. Cluster assignments on the individual level were unstable over one week, ICC = 0.25, 95% CI [-0.09,0.53]. We were able to successfully replicate the pattern of clustering in a two-cluster k-means analysis in a sample of people with CUD at two lab visits. However, these findings suggest that these clusters may mostly reflect state-level factors rather than trait-like individual differences in CUD, which could limit their clinical utility. Future studies should further assess the psychometrics of this approach in different samples and consider state-like influences that may impact an individual's neuroaffective reactivity profile at any given time.

Title: Comparison of new fall treatment programs for control of Varroa destructor in managed honey bee colonies

Primary Author: Brandon Shannon

Additional Authors: Agostina Giacobino; Ben DeMoras;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Recent beekeeper surveys determined that 56% of managed honey bee colonies were lost over the 2024-2025 season, which was primarily driven by the ectoparasitic mite, Varroa destructor. Several new miticide products have been recently developed to control this pest, including the oxalic acid extended-release strip, VarroSan®; the amitraz flash (short-term) treatment gel, AmiFlex®; the amitraz extended-release strip, Apivar 2.0®; and a proprietary thymol formulation developed by Vetopharma that is not yet registered for use. The goal of this study was to evaluate colony-level efficacy of fall Varroa treatment programs using these newly developed miticide products. Because AmiFlex® is a flash treatment, it was incorporated into a management strategy that included oxalic acid or thymol extended-release formulations that provide long-term control. The treatment groups included (1) Apivar 2.0®, (2) AmiFlex® followed by the proprietary thymol product, (3) AmiFlex® followed by VarroSan®, and (4) VarroSan® followed by AmiFlex®, all compared to the current standard, Apivar®. This study monitored a total of 60 colonies, with treatment periods ranging from 49-70 days, where the maximum labeled treatment period was used for each individual treatment group. Measurements included alcohol washes to determine Varroa infestation rate on adult bees, sticky boards to assess Varroa mite drop efficacy throughout the treatment period, and Liebfeld assessments to estimate colony strength. Results demonstrate that Apivar 2.0® provided effective Varroa control without compromising colony strength under the conditions of this study. Additionally, VarroSan® was not consistently effective when applied alone, but was more effective following a flash treatment. This research fills key knowledge gaps regarding the efficacy of the newest treatments for Varroa control to provide immediately actionable solutions for beekeepers.

Title: Effects of PGPB and Biochar Loading on Early Growth in Soybean Using Natural Polymers as Seed Coating

Primary Author: Brea Thomas

Additional Authors: Iris Vega Erramuspe;

Mentor: Iris Vega Erramuspe

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Abiotic and biotic stressors reduce the yield of uncoated seeds, decreasing productivity. Seed coating (SC) has been widely adopted since the 1960s to mitigate these effects. SC applies external materials to the seed surface to improve performance under adverse conditions while maintaining seed shape. Conventional SC often uses non-renewable, non-biodegradable materials, which can accumulate in soils, affect water retention, root–microbe interactions, and plant growth. Natural polymers provide a cost-effective, renewable, and biodegradable alternative for SC materials. They support soil health and promote seed hydration, oxygen diffusion, and plant growth. They are compatible with Plant Growth–Promoting Bacteria (PGPB), often referred to as plant probiotics, which enhance nutrient availability, stress tolerance, and root development. *Azospirillum brasilense*, a diazotrophic PGPB, offers additional benefits via rhizoplane colonization. These benefits include improving germination, phytohormone production, stress tolerance, and uniform seedling emergence with larger root systems. In this study, soybean seeds were coated with formulations based on carboxymethyl cellulose, λ -carrageenan, and chitosan. Each SC polymer was used to adhere biochar and alginate microbeads encapsulating *A. brasilense*. Effects on germination were evaluated by measuring root length, shoot length, and dry weight under controlled conditions. Viable *A. brasilense* in microbeads was quantified using viability assays, and root hairs were examined to assess attachment of PGPB–encapsulated microbeads. These results will guide the development of advanced, multifunctional SC systems to enhance seed protection and support optimal plant growth.

Title: Tracking Paleocommunity Changes During Regional Sea-level Rise Using Cretaceous Fossil Assemblage Data

Primary Author: Breawna Cook

Additional Authors: Thomas Cullen;

Mentor: Thomas Cullen

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: By studying the distribution of fossil species across multiple geological sites, we can provide insight into paleoecology. Identifying fossil taxa known to thrive in specific environments, paleontologists can reconstruct ancient environments and track changes in environments and ecosystems over time. To examine this, we analyzed fossils from four sites sampled from sediments of the Late Cretaceous of Alberta and Montana. These sites span approximately 3 million years and preserve a major shift in regional sea levels and paleoenvironmental conditions. For each site, the fossil specimens were collected, sorted, identified, and quantified by abundance and composition for comparison among sites. These results were analyzed based on the presence or absence of taxa associated with freshwater, marine, and transitional environments, indicating a clear environmental shift from predominantly freshwater to fully marine conditions, with intermediary animals present across all four sites. These patterns suggest fluctuations in environmental conditions during this time interval and demonstrate how analyses of fossil assemblages can be used to infer environmental changes and provide a framework for understanding ecological responses to habitat change. These analyses will be expanded in the future to compare across a broader spatiotemporal range of sites, and specimens from these sites will be analyzed using stable isotope approaches to more precisely quantify changes in ecosystem structure over the sampled intervals.

Title: Predictive modeling for native bacteria growth and shelf-life prediction of chicken wings

Primary Author: Brenda Jovel Gonzalez

Additional Authors: Zhen Jia;Landon Rohling;Arabella Jones;Cameron Smith;Kate Owen;Amit Morey;Shabarinath Srikumar;

Mentor: Zhen Jia

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Native bacteria are the primary contributors to spoilage in poultry products and are commonly used as indicators for shelf-life determination. This study characterized the growth behavior of native bacteria (NB) on chicken wings during storage at 4, 10, and 20°C and developed predictive models to estimate microbial shelf life under refrigerated and temperature-abuse conditions. NB populations were enumerated over time and modeled using a primary no-lag phase growth model. The effect of temperature on the maximum growth rate was described using a Ratkowsky square-root secondary model. NB exhibited growth at all storage temperatures, with increasing growth rates as the temperature increased. At 4 and 10°C, NB populations increased gradually and reached 8–9 log CFU/mL rinsate within 10 and 6 d, respectively. At 20°C, NB grew rapidly and reached the stationary phase within ~37 h. The no-lag phase model could adequately describe NB growth across all temperatures, with low RMSE values (0.4–0.5 log CFU/mL rinsate). Model validation confirmed acceptable predictive performance, with approximately 76% of predictions within ± 0.5 log CFU/mL rinsate of observed values. A spoilage threshold of 7 log CFU/mL rinsate was applied to estimate microbial shelf life. Model simulations demonstrated that shelf life decreased markedly with increasing temperature and higher initial NB loads. Integration of the primary and secondary models provided a quantitative framework for predicting chicken wing shelf life across a range of storage temperatures and initial microbial conditions, highlighting the critical role of temperature control in poultry shelf-life management.

Title: Bankruptcy filings with Farm Service Agency (FSA) loan obligation: a measure of farm financial stress

Primary Author: Bridget Yeboah Bafowaa

Additional Authors: Adam Rabinowitz;

Mentor: Adam Rabinowitz

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Farm financial stress often leads to farm exits which affect both the agricultural sector and the broader economy. As crop prices remain low, producers face greater pressure on farm liquidity, which in turn increases the demand for loans and subsequently drive-up debt accumulation. For those facing extreme financial stress, the United States bankruptcy law allows for the reorganization and discharge of debts, with chapter 12 specifically designed for farmers. However, ineligibility for chapter 12 leads some farmers to explore alternative liquidation or reorganization chapters (7, 11, or 13). Previous studies have used chapter 12 filings as a proxy for farm bankruptcies and measures of farm financial stress. This paper takes a different approach by using filings with Farm Service Agency (FSA) obligations across all four major bankruptcy chapters (7, 11, 12, and 13) as a more general indicator of farm financial stress. FSA provides credit to farmers, particularly those who do not qualify for conventional loans. Using cases with FSA loan obligations ensures that the entity filing for bankruptcy is a farm. Preliminary results show about 58% of farm bankruptcies with FSA obligations are filed under chapters 7, 11, or 13, illustrating the challenges of using only chapter 12 filings as a proxy for farm financial stress. We used data from the Public Access to Court Electronic Records and the Integrated Database from the Federal Judicial Center. We explore differences in financial characteristics and outcomes of filers across chapters using descriptive analysis and multinomial logit models. This research provides policymakers with insights on the effectiveness of chapter 12 bankruptcy for a subset of farmers (those with FSA loans). Given the continued uncertainty in agriculture, there is a need to gain a better understanding of farms in extreme financial stress that turns to legal means of recovery from a law that has seen minimal change since its inception in the 1980s.

Title: Application of spectrophotometric and liquid chromatography–mass spectrometry methods to assay activity of iodothyronine deiodinases expressed in *E. coli*

Primary Author: Brody Church

Additional Authors: Katherine Rush; Susan Short;

Mentor: Katherine Rush

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Iodothyronine deiodinases are a family of enzymes that catalyze the removal of iodine atoms from thyroid hormones (THs). Through site-specific iodine removal, deiodinases regulate TH activation and inactivation, playing a crucial role in maintaining metabolism, growth, and development. Deiodinases are vertebrate enzymes not natively found in bacterial systems and contain the rare amino acid selenocysteine, whose incorporation requires specialized translational machinery. As a result, functional studies of deiodinases have largely been limited to eukaryotic systems. To enable downstream purification and mechanistic studies, efforts to express these enzymes in a bacterial system required validation of enzymatic activity throughout the expression process. To accomplish this, two published methods were implemented: a spectrophotometric assay to rapidly screen for deiodination and a liquid chromatography–mass spectrometry (LC–MS) assay to quantitatively detect product formation. The spectrophotometric assay utilizes the Sandell–Kolthoff reaction, in which iodide released from substrate molecules catalyzes a redox reaction that produces a measurable change in absorbance; the rate of change reflects the extent of deiodination. For quantitative analysis, LC MS was used to measure the concentrations of products after enzymatic deiodination of TH substrates, providing a detailed assessment of substrate conversion and product formation. Activity detected in the spectrophotometric assay was corroborated by LC–MS, confirming the reliability and validity of both methods. Using these methods, successful heterologous expression and catalytic activity of human deiodinases in *E. coli* were confirmed, with LC–MS analysis indicating that substrate conversion exceeded 70% in the most active samples. This validation enabled subsequent purification and mechanistic studies aimed at elucidating intermediate states in deiodinase catalysis.

Title: Analysis of a Generic T-tail Transport Using a Surface-vorticity Panel Method Flow Solver at Low Angles of Attack

Primary Author: Cade May

Additional Authors:

Mentor: Roy Hartfield

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: A panel method flow solver with viscous capabilities was used to determine stability characteristics, including dynamic stability derivatives, of a well-studied generic T-tail (GTT) transport aircraft model. Longitudinal, lateral, and directional static characteristics were computed using the steady and pseudo-steady state solver modes within the FlightStream® panel method flow solver. The effects of control surface deflections were also investigated. Dynamic stability derivatives were computed using the pseudo-steady state and unsteady state solver modes. The results of each solver mode were compared in accuracy. The unsteady solver results were computed using the forced oscillation (F-O) method and post-processed using an integration method. All results were compared against published experimental and computational fluid dynamics (CFD) data. The published experimental data consisted of wind tunnel testing results. Across all cases studied, the panel method results aligned well with the wind tunnel data. Both solver modes used for dynamic derivative computations agree with published data in sign and relative magnitude. The solver did not correctly capture the same trends seen in experimental data in every case, but the data support the use of the tool as a rapid preliminary design and analysis tool for approximate results. The effects of using varying total amounts of forced oscillation cycles on the unsteady solver precision were also studied, with the results showing that the unsteady solver produced similar data at all numbers of cycles used with the forced oscillation method. The advantages of using the solver in finding dynamic stability parameters include low computational cost, significantly reduced computation times, and the requirement of only surface meshes. The solver showed promising capabilities in rapidly calculating a wide range of aerodynamic characteristics, supporting its use in the preliminary design process.

Title: Making student engagement data readily available: Interactive dashboards to support data-informed decision-making in student affairs

Primary Author: Caitlin Bates

Additional Authors:

Mentor: Vanessa Harrison

Department/Program: Business Analytics and Info Systems

College: Harbert College of Business

Abstract: Student Affairs (SA) at Auburn University relies heavily on data-informed decision-making to enhance student learning, success, and development. To support this goal, the office of Assessment and Strategic Planning fosters a culture of evidence across 21 SA departments by providing assessment services, resources, and training. However, key engagement data, including recreation usage, student involvement, and Greek life, are often reported through time-intensive, manual processes that limit timely and actionable insights. Improving how these data are organized and made readily available is critical for identifying engagement patterns, supporting decision-making, and improving operational efficiency within SA. This project developed a suite of interactive Power BI dashboards at Auburn University designed to organize existing departmental data in an accessible, consistent format. Dashboards include Recreation & Wellness usage trends, Student Involvement participation and leadership tracking, and Greek Life council-level grade reporting with interactive filters. Findings reveal distinct engagement patterns across student populations, highlight peak recreation usage periods, and open up the opportunity for cross-organization comparisons of participation and academic performance. These dashboards provide a scalable and efficient framework for organizing engagement data and supporting timely, data-informed decision-making across SA units.

Title: The role of calcium signaling on axial patterning and specification in sea urchin embryos

Primary Author: Callum Newberry

Additional Authors: Ryan Range; Jennifer Fenner-Range;

Mentor: Jennifer Fenner-Range

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Wnt signaling drives the specification and patterning of germ layers (endoderm, mesoderm, and ectoderm) along the anterior-posterior (AP) axis during early embryonic development across metazoans, from cnidarians to humans. In sea urchin embryos AP axis formation is controlled by an integrated Wnt signaling network of canonical (Wnt/ β -catenin) and non-canonical (Wnt/JNK and Wnt/PKC) pathways. Despite the importance of Wnt signaling in many developmental processes we still have a limited understanding of how these different Wnt signaling cascades interact during embryogenesis in any model system. Our lab has previously shown that non-canonical Wnt/PKC signaling is broadly active during early AP axis specification, suggesting that calcium signaling is necessary for AP patterning in the sea urchin. However, we still lack a full understanding of the calcium signaling cascade involved in axial patterning. The goal of my research is to examine the role of calcium signaling molecules in embryonic axis formation to assess if the Wnt/calcium signaling cascade is necessary for early embryonic development. We investigated the effects of 3 calcium signaling inhibitors (Calcineurin, CAMKII, and IP3 inhibitors) on sea urchin embryogenesis. In the calcineurin inhibitor, the embryos failed to develop mesoderm-derived pigment cells. In the CAMKII inhibitor, the skeleton did not form, and the gut formed outside of the body. Lastly, in the IP3 inhibitor, we saw that both the skeleton and gut formed. These results suggest that all three molecules are necessary for embryogenesis but may be involved in different Wnt pathways. We used in situ hybridization (WMISH) to examine how two genes involved in axis formation (*foxq2* and *bmp2/4*) were impacted by the CAMKII inhibitor. Our results showed that both genes were downregulated yielding the same phenotype observed in Wnt/PKC inhibition. This suggests the calcium signaling molecule is required for axial patterning in the sea urchin embryo.

Title: FAAH SNP moderates link between momentary cannabis craving and subsequent cannabis use in daily life

Primary Author: Cambria Beane

Additional Authors: Sara Blaine;

Mentor: Sara Blaine

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Cannabis use among young adults has increased over the past decade; however, not all recreational users develop problematic use. Biopsychosocial risk factors have a critical role in distinguishing cannabis users with and without cannabis use disorder, underscoring the importance of studying genetic influences. Fatty acid amide hydrolase (FAAH) metabolizes anandamide, and the risk allele of the FAAH single nucleotide polymorphism (SNP), rs324420, has been associated with cannabis craving and withdrawal in several GWAS studies. We examined the moderating effect of this allele on the relationship between within-person momentary craving and ensuing cannabis use. Participants included 155 young adults (age 18-30) who recreationally use cannabis and completed 21 days of smartphone-based surveys assessing craving and subsequent cannabis use. Each day included six semi-random prompted surveys and morning and evening surveys. Buccal swabs were collected at intake for genetic analysis. Data were analyzed in R using negative binomial multilevel models with random intercepts and slopes. There was a significant cross-level interaction between within-person momentary craving and the presence of the FAAH SNP on subsequent cannabis use and the number of hits (Estimate = 0.21, 95% CI [0.11, 0.31]; IRR = 1.01, 95% CI [1.00, 1.02], $p = 0.004$, respectively), controlling for age, sex, and weekend/weekday use. Simple slopes analysis indicated there was a stronger association between within-person craving and subsequent cannabis use and hits when the FAAH SNP was present. Presence of the FAAH risk allele rs324420 was associated with a stronger craving-use relationship, conferring greater risk for both cannabis use and greater quantity of use in the next moment. Indeed, genetic variation in endocannabinoid signaling may influence the strength of craving-use associations in daily life, informing an individualized approach to risk identification, prevention, and intervention development.

Title: Formation and characterization of zein–chitosan polyelectrolyte complexes (PECs)

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Abstract

Polyelectrolyte complexes (PECs) formed by interactions between biopolymers have attracted attention for their nutritional and technological applications in food, cosmetics, and bioremediation. Although many protein–polysaccharide combinations have been studied, some remain underexplored, limiting scientific and technological advances. The combination Zein (ZN)–chitosan (CHS) is one such case. This study addressed this gap by preparing ZN–CHS PECs through simultaneous addition of their dispersions under varying pH (4.1, 5.1, 7.1), ZN:CHS ratios (1:2, 1:1, 2:1), and temperatures (25 °C, 45 °C). PECs were characterized by visual observation, Tyndall effect, hydrodynamic diameter via dynamic light scattering, and zeta potential (ζ) by electrophoretic analysis. Results showed that acidic pH (4.1 and 5.1) favored the formation of stable colloidal nanostructures (nano-PECs) with a clear Tyndall effect, whereas pH 7.1 led to macroscopic aggregates (macro-PECs) and phase separation. Temperature effects were pH-dependent: at 25 °C, the smallest diameters occurred at pH 4.1 (300–450 nm) and 5.1 (540–650 nm); at 45 °C, the size of nano-PECs at pH 4.1 increased significantly (570–660 nm). Nano-PECs exhibited high positive ζ -potentials (+40 mV at pH 4.1; +30 mV at pH 5.1), indicating formation mediated by hydrophobic interactions, hydrogen bonding, van der Waals forces, and entropic contributions such as the release of counterions and water molecules. In contrast, macro-PECs formed at pH 7.1 showed near-zero negative ζ -potentials (–10 mV), suggesting that electrostatic interactions contributed to the complexation process. These findings demonstrate that the structure and stability of PECs can be rationally tuned via a simple, rapid process. Nano-PECs (ZN:CHS) show promising potential for the encapsulation and controlled release of bioactive compounds, while macro-PECs are suitable for pollutant adsorption, topics of growing interest in recent years.

Title: Ecosystem water use efficiency of geographically isolated wetlands

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Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Geographically isolated wetlands (GIWs) are a common landscape feature in the lower Apalachicola-Chattahoochee-Flint basin. GIWs are known for the abundance of ecosystem services they provide including water filtration, sediment and nutrient retention, and water storage which can help mitigate both floods and droughts. While GIWs are beneficial, their role in watershed hydrology and carbon cycling remains unclear. It is generally unknown how much water is used by vegetation in these wetlands or how efficiently they might be using the water to store carbon and produce biomass. This project will investigate the evapotranspiration (ET), above ground net primary productivity (NPP), and water use efficiency (WUE) of two relatively undisturbed geographically isolated wetlands (GIWs) on The Jones Center at Ichauway, Newton GA. These wetlands lack surface connections to other water bodies, and hydrology is predominantly driven by rainfall and subsurface flow. Quantifying these three variables will provide a better understanding of water use and associated ecosystem services. ET was measured every 30 minutes using a Li-Cor 710 ET sensor. Leaf level WUE of dominant plant species was assessed using a Li-Cor 6400 gas exchange system. Above ground productivity was quantified through clip plot sampling and by applying a weighted WUE value to the ET data to calculate sub-daily NPP. We found that wetland ET was near zero in winter, rapidly increased in April, and was highest in the summer months (June-August). Temporal variations in ET were driven by net radiation and phenology of dominant vegetation. WUE varied substantially by species. Species furthest from the wettest and deepest point of the wetland were more water use efficient than those located at the deepest point creating a range of diversity throughout these ecotones. While we found 35 species within the wetland boundary, productivity was dominated by broomsedge (*Andropogon virginicus*) around the relatively dry outside rim. Further analysis will examine the potential role of different vegetation types in maintaining wetland productivity while reducing ET, protecting two key functions of wetlands. These findings give us a better understanding of water use and carbon storage within these ecosystems. This helps to inform us of GIWs' ecological role within the landscape to help us enhance management strategies and to better protect and conserve ecosystems.

Title: Enhancing intracellular mRNA delivery using stearic acid-modified BAPCs

Primary Author: Carlos Nazareno

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Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Efficient intracellular delivery systems are critical for advancing mRNA-based technologies in both therapeutic and research applications. Branched amphiphilic peptide capsules (BAPCs) are nanomaterials capable of delivering nucleic acids and other therapeutic cargos into cells. While BAPCs have demonstrated the ability to promote cellular uptake and protect mRNA during delivery, limited endosomal escape and cytosolic release can reduce the amount of functional mRNA available for protein translation. This project investigates whether modifying BAPC composition can enhance delivery efficiency by improving endosomal escape. Specifically, a modified BAPC formulation incorporating 20% stearic acid is evaluated as a strategy to strengthen nanocarrier–membrane interactions and promote endosomal disruption. The central hypothesis is that this hydrophobic modification will enhance cellular uptake, endosomal escape, and downstream protein expression relative to unmodified BAPCs. An in vitro cell-based model using Chinese hamster ovary (CHO) cells is employed to assess delivery performance. Cells are transfected with mRNA using both modified and unmodified BAPC formulations, and protein expression is quantified by Western blot analysis. Relative expression levels are used to compare delivery efficiency between formulations. The outcomes of this study will determine whether stearic acid–modified BAPCs improve intracellular mRNA delivery and increase protein expression, with success defined as achieving at least a 10% increase compared to the unmodified formulation. If successful, these findings will provide insight into the role of hydrophobic modification in BAPC-mediated delivery and inform future design strategies for peptide-based nanocarriers. Ultimately, this work may contribute to the development of more efficient and versatile nucleic acid delivery systems, supporting applications such as vaccine development and cancer therapeutics.

Title: Evaluating the Effect of Prenatal Cannabinoid Exposure on Placental Lipid Transport and Accumulation

Primary Author: Carly Parker

Additional Authors: Miranda Reed;Adrian Courville;Josh Baskaran;Cristine Camp;

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College: College of Sciences and Mathematics

Abstract: As more states legalize recreational and medicinal cannabis, rates of cannabis consumption have risen across most demographics, including pregnant women. However, population studies suggest a link between prenatal cannabinoid exposure (PCE) and altered metabolic health of offspring. As the placenta is a key mediator of fetal metabolism, we hypothesized that PCE alters placental metabolism. In this study, pregnant rats were exposed daily to vaporized Δ^9 -tetrahydrocannabinol (THC; 100 mg/mL) or polyethylene glycol 400 (PEG; vehicle control) from gestational days (GD) 5-18. On GD19, fetuses and placentas were collected. Both fetal and placental weights were significantly higher in the THC group ($p < 0.05$), suggesting metabolic alterations. We next isolated RNA from placentas and performed RNA-sequencing. The PCE placentas had over 1,100 differentially expressed genes. Downstream gene ontology analysis showed enrichment of pathways related to lipid catabolism and protein-lipid complex formation. To assess corresponding protein changes, we quantified markers of placental lipid transport and catabolism using Western blotting. We found that the apolipoprotein, ApoE, was significantly elevated in the THC-exposed placentas ($p < 0.05$). To determine if changes in gene and protein expression corresponded with increased lipid accumulation in the placenta, we visualized lipid deposition using Oil Red O staining. THC-exposed placentas exhibited increased lipid accumulation compared to the PEG control group. This study establishes a link between PCE and increased lipid catabolism, protein-lipid complex formation, and lipid accumulation in the placenta. Additionally, increased placental ApoE is correlated with preeclampsia and preterm birth, suggesting a much larger role for PCE in placental dysfunction and adverse pregnancy outcomes. Overall, this work supports a role for PCE in influencing placental lipid metabolism, with potential consequences for fetal metabolic programming.

Title: Advanced manufacturing systems research using a desktop 5-axis CNC machine

Primary Author: Carson Schick

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Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: Advanced manufacturing research often relies on large industrial CNC machining centers, which are costly and challenging to operate. This project demonstrates a lower-cost approach using a Pocket NC desktop 5-axis CNC milling machine as an accessible platform for studying machining processes and manufacturing data. The purpose of this research is to examine the potential of combining in-process machine data with post-machining inspection data to understand existing relationships and create new ones. Specifically, we investigate how live sensor signals and machine parameters can be linked to measurable effects in the finished part. This approach supports a two-part manufacturing analysis by enabling experimentation and data collection on a compact system without requiring large and expensive equipment. During machining, the Pocket NC collects multiple types of sensor data, including vibration, acoustic, and temperature data, along with process parameters such as spindle speed and feed rate. After machining, parts are inspected using the Keyence Blue Light scanner at ICAMS. The scanner helps us measure the quality of our machined parts, which includes tolerance. Then we use a Profilometer to examine the part's surface and geometric quality. We analyze the data in Python by summarizing sensor signals over short time intervals using descriptive statistics. Lastly, we compare the trends we identified in the in-process data with those in the inspection data to assess how machining conditions relate to part quality. The resulting dataset provides a basis for process improvement analysis, recommended parameters for optimal quality, and machine health monitoring on a desktop CNC machine. In conclusion, this research demonstrates that desktop 5-axis machines can produce valuable manufacturing data and enable data-driven research linking in-process monitoring to post-process quality.

Title: Deep Neural Network Pose Estimation and Modelling of Butterfly Flight Aerodynamics

Primary Author: Carter Freeman

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Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Seasonal morphological variations in *Zerene cesonia* (the Southern Dogface Butterfly) result in these butterflies having different wing colorations. *Zerene cesonia* exhibits two morphs: a winter morph and a summer morph. When *Zerene cesonia* are reared in winter conditions they have pink coloration on their wings, and when they are reared in summer conditions the entirety of the butterflies' wings are yellow. Moreover, the recent increase in the accessibility of high-quality, neural network based, computer vision, pose estimation software like DeepLabCut allows novel approaches to animal behavior questions in biology. This research utilizes the novel application of DeepLabCut to assess how seasonal morphology in *Zerene cesonia* impacts flight efficiency. The first objective of this project will assess the ability of DeepLabCut to accurately monitor the climbing flight of *Zerene cesonia*. The second objective of this research is to utilize the pose estimations from DeepLabCut to approximate the flight efficiency of both the cold and warm morphs of *Zerene cesonia* in climbing flight. The third objective is to make a comparison of flight efficiency between the two morphs. Specimens of *Zerene cesonia* have been reared in conditions simulating the summer and winter conditions that naturally produce morphological variation. These specimens were flown in a flight chamber and videoed from two angles using RGB cameras. Then these flight videos are used to train 3D DeepLabCut models, which use triangulation to estimate the butterflies' positions in 3D space. This information, along with the butterflies' wing dimensions and weights, allows for the analysis of their flight efficiency.

Title: Cell type-dependent behavior of breast cancer 3D tumor models: analysis of aggregate and microsphere models

Primary Author: Casey DuBrow

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Mentor: Elizabeth Lipke

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Three-dimensional (3D) in vitro tumor models more accurately recapitulate the in vivo tumor physiology than traditional two-dimensional (2D) cultures. Scaffold-free tumor models, aggregates, formed by self-assembly, are simple to culture, yet they frequently exhibit inconsistencies in morphology and mechanical stability. Scaffold-based hydrogel microspheres produced through microfluidic encapsulation provide structure to improve morphological consistencies and mechanical properties. The production of a consistent model is a necessity for high-throughput applications such as drug screening and tissue expansion. This study investigates scaffold-free versus scaffold-based models and cell type-dependent impacts, building on prior work with metastatic breast cancer (MDA-MB-231), non-metastatic breast (MCF7), and colorectal (HT29) cancer lines. Tumor models were cultured and evaluated over a 14-day period using phase-contrast and fluorescence microscopy, viability staining, and mechanical testing. Quantitative image analysis and statistical evaluation of key measurements of shape descriptors were collected to assess variability across time points and between models. Both breast cancer aggregates exhibited pronounced morphological irregularity with low and declining circularity values, indicating progressive loss of spherical consistency. In contrast, HT-29 aggregates underwent transient compaction with increased circularity at intermediate time points. The spherical properties of HT-29 aggregates approached those of the breast cancer microspheres, magnifying the influence of cell type on tumoroid architecture. Although comparable in size by day 14, microsphere models demonstrated a more uniform and stable growth pattern than aggregates. These results demonstrate that cancer cell phenotype significantly influences the consistency of 3D tumor models and underscore the microsphere model as a reliable method to mitigate cell type-dependent variability.

Title: An Efficient Latency-Based Functional Analysis of Socially Inappropriate Behavior and Its Precursors in Autism Spectrum Disorder

Primary Author: Catherine Winter

Additional Authors: John Falligant;Hastings Sears;

Mentor: John Falligant

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Approximately 25% of individuals with autism spectrum disorder (ASD) engage in inappropriate sexual behaviors, such as inappropriate touching of others (ITO). Broadly defined, ITO involves physical contact that is excessive, intrusive, or sexual in nature and violates typical social boundaries. The assessment of ITO is a sensitive topic but is vital to understanding the function of these behaviors as well as the precursors to those behaviors so that effective interventions can be developed to decrease ITO before it occurs. Functional analyses (FAs) are considered the gold standard for identifying the environmental variables that maintain challenging behavior, providing a critical foundation for developing effective, function-based interventions. The present study demonstrated the efficient and effective use of a latency-based FA to identify the environmental variables maintaining ITO in a young male diagnosed with ASD. The FA also sought to identify precursor behaviors that are functionally equivalent to ITO to identify behaviors that could be targeted. FA results indicated that ITO was maintained by social attention. This information was then used to design and implement a behavioral treatment that successfully eliminated occurrences of ITO, highlighting the value of latency-based FA procedures for assessing and treating sensitive or low-frequency forms of challenging behavior.

Title: Optimization of continuous hydrotreatment of waste cooking oil: integrating experimental data with Box-Behnken design and machine learning

Primary Author: Chandra Khanal

Additional Authors: Sagar Kafle; Sushil Adhikari;

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College: College of Agriculture

Abstract: Renewable diesel produced via hydrotreating of lipid-based feedstocks offers a promising pathway to reduce greenhouse gas emissions and dependence on fossil fuels. However, the hydrotreating process is highly sensitive to operating conditions and requires optimization due to high hydrogen consumption and energy demand, especially when waste cooking oil (WCO) is used as the feedstock. This study aims to develop and optimize a continuous hydrotreating process for WCO using an MgO-promoted 10Ni-5Mo/Al₂O₃ catalyst via an integrated Design of Experiments (DoE) and machine learning (ML) framework. Although hydrotreating is the most commercially established route for renewable diesel production, most existing studies investigate the effects of operating parameters by varying one condition at a time in continuous fixed-bed reactors. This approach limits understanding of the combined and interactive effects of temperature, pressure, and liquid hourly space velocity (LHSV), and hydrogen availability on process performance. A three-factor Box–Behnken design (BBD) was employed to systematically evaluate the effects of reaction temperature (300–400°C), pressure (400–600 PSI), and LHSV (1.0–2.0/h), while maintaining a constant H₂-to-oil ratio of 750 cm³/cm³. The experimental matrix consists of 15 runs, including 3 center points to assess reproducibility. The MgO-promoted 10Ni-5Mo/Al₂O₃ catalyst was prepared via wet impregnation, followed by calcination and in situ sulfidation to activate the metal sites. Product streams were characterized using GC-MS, SimDist, fractional distillation, and CHNS analysis, while catalyst structure and surface properties were examined using XRD, BET, SEM, and XPS. Experimental data from the DoE were used to train machine-learning models to capture the combined effects of operating conditions on renewable diesel yield and fuel quality, extending beyond traditional one-factor-at-a-time optimization approaches commonly used in WCO hydrotreating studies. These predicted conditions were validated experimentally through a confirmatory run. Overall, this work addresses a key research gap by providing a systematic, continuous, and data-driven optimization strategy that explicitly accounts for interactions among operating variables in the production of renewable diesel from WCO.

Title: Evaluation of CMA-ES for automated calibration of HEC-HMS stormwater models

Primary Author: Chase Frazier

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Mentor: Frances O'Donnell

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: The fast pace of urban development has made managing urban stormwater a challenge. The Army Corps of Engineers Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) is used to predict flows and evaluate the performance of stormwater controls under natural conditions and hypothetical design storms. In order to be useful, hydrologic models need to have parameters adjusted to match observed data. The process is called calibration and can take a lot of time and energy given the complexity of large environments. Machine learning-based calibration methods automate parameter estimation by evolving a population of candidate solutions across generations to optimize model performance, making them well suited for complex hydrologic systems. Non-dominated Sorting Genetic Algorithm II (NSGA-II), Particle Swarm Optimization (PSO), and Differential Evolution (DE) are three popular multi-objective machine learning strategies that are the industry standard for model calibration. NSGA-II, PSO, and DE are widely used for hydrologic model calibration; however, Covariance Matrix Adaptation Evolution Strategy (CMA-ES) has not yet been directly evaluated or compared within the HEC-HMS framework. To compare the strategies, each strategy performed calibration of HEC-HMS's stormwater parameters using a data set from a thesis by Reid McDaniel that observed stormwater runoff data from a recently urbanized watershed. Each of the tested strategies started with a population of 16 and was given 30 generations to calibrate the HEC-HMS model to the observed data by changing Clark Unit Hydrograph parameters T_c and R , which are responsible for informing how stormwater runoff is calculated. CMA-ES calibration achieved Nash–Sutcliffe Efficiency (NSE), Percent Bias (PBIAS), and Root Mean Square Error (RMSE) values of 0.99961, -7.48% , and $3.48E-5 \text{ ft}^3/\text{s}$, respectively. Compared to the standard techniques CMA-ES tends to take longer to converge on a near-optimal solution.

Title: Predicting Treatment-Resistant Depression Among Medicare Beneficiaries Using Machine Learning

Primary Author: Chih-Ting Lai

Additional Authors: Surachat Ngorsuraches;Kimberly Garza;Cherry Jackson;Jingjing Qian;Jingyi Zheng;

Mentor: Surachat Ngorsuraches

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: This study aims to develop machine learning models to predict treatment-resistant depression (TRD). This study used data from the 2017-2022 Medicare Current Beneficiary Survey, with the study cohort including beneficiaries with diagnosed depression. Outcomes were categorized into TRD (exposure to ≥ 2 antidepressants without remission, based on Patient Health Questionnaire 8-items [PHQ-8] ≥ 5 , or use of atypical antipsychotics or ≥ 3 antidepressants) versus non-TRD (remission [PHQ-8 < 5] following any antidepressant treatment). Predictors included demographics, comorbidities, and social determinants of health (SDoH, e.g., social activity, food insecurity). Three machine learning models: random forest (RF), support vector machine (SVM), and eXtreme Gradient Boosting (XGBoost) models were applied, and logistic regression was used as a benchmark. The five-fold cross-validation during training with a temporal split (i.e., Train: 2017-2021; Test: 2022) was used to assess out-of-sample performance. To enhance model utility, an AUC-weighted least absolute shrinkage and selection operator (LASSO) was used to select a subset of training features. Model performance was evaluated using the area under the receiver operating characteristic curve (AUC) with a 95% confidence interval (CI) obtained via bootstrap. A total of 1363 observations were included, with 31% classified as TRD. Compared with the logistic benchmark (AUC: 0.78; 95%CI: 0.71-0.85), the RF (AUC: 0.85; 95%CI: 0.78-0.91, $p=0.046$), XGBoost (AUC: 0.83; 95%CI: 0.76-0.89, $p=0.148$) and SVM (AUC: 0.82; 95%CI: 0.75-0.88, $p=0.092$) had slightly better performance. Notably, the LASSO-selected variables retained robust performance in the RF model (AUC: 0.84; 95% CI: 0.78-0.90), suggesting that health systems could leverage advanced ML models to proactively identify high-risk populations for individualized interventions.

Title: Effectiveness of alternative hybrid methods in photography and art within the realm of design

Primary Author: Christine Pham

Additional Authors:

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Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: Alternative photographic processes can operate as interdisciplinary tools for ecological documentation and socio-cultural representation within local ecosystems in Alabama. Local communities in Alabama are embedded into material contributions, by being portrayed and represented figures of the areas, conceptualizing a lived terrain shaped by labor, displacement, and cultural memory. By combining alternative photographic practices with digital visualization, hybrid workflows function as critical design research methods, producing knowledge that is both environmentally situated and socially accountable. Four analog methods, lumen prints, cyanotypes, chlorophyll prints, and chemigrams are used to produce light, chemical, and physical based photos. Production involves printing with silver gelatin paper, Ferric Ammonium Citrate and Potassium Ferricyanide coated materials, organic matter, and digitally produced imagery. Materials are placed into custom-built contact printing frames, exposing them to both natural and controlled lighting as well as implementing traditional wet black and white dark room processes. Utilizing native plant species as vessels for various materials and methods, they are incorporated as printing plates, chemical mediums, and symbolic objects. Photography at each location consists of historically significant buildings, neighborhoods, land, businesses, and candid interactions with locals that can inform marginalized communities as well as connect them to their ecosystems. Physical artifacts are translated into digital forms through scanning, animation, digital photography, and modeling. This secondary phase generates representations that embed ecological data and cultural narratives into immersive digital assets that aim to retain and refine the original physical qualities of the work that are often lost in digital translation. Representation is done through animation, lighting simulations, and 3-Dimensional scans. Choices in method and production for each location act as a deliberate decision to emphasize the effectiveness of material contribution to visual narrative and representation. Since photography is generally considered a flat medium, scans and animations are able to re-establish object and scenes in scale, form and interactions with natural environmental interferences. These final visual artworks serve as new and innovative ways to connect with inhabited ecologies and revitalize traditional or forgotten processes.

Title: Computational description of surface states in artificial quantum lattices

Primary Author: Christopher Coger

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Mentor: Marcelo Kuroda

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Recent experiments have shown that carbon monoxide (CO) molecules deposited on Cu(111) surfaces serve as powerful platforms for probing topological quantum effects in artificial lattices. In this multiscale computational study, we integrate density functional theory (DFT) and density functional tight-binding (DFTB) to characterize the electronic properties of such systems. Accurate DFT calculations of CO adsorption validate and calibrate our DFTB parameterizations. Leveraging DFTB, we then simulate extended lattices similar to those attained experimentally. Quantum confinement of surface states emerging in honeycomb and Kagome-like lattices are systematically analyzed varying molecular spacing and adsorption registries. Our results agree with recent experimental work on these systems and demonstrate that fine-tuning lattice parameters can markedly alter the electronic landscape and coherence properties of these artificial systems. These atomistic insights establish clear structure–property relationships and provide critical guidance for experimental efforts to develop robust, tunable CO-based platforms for quantum information sciences.

Title: Exploring the Health and Diet-Related Behavioral Impacts of Double Up Food Bucks in Alabama

Primary Author: Christopher Issa Khalaf

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Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: The United States Department of Agriculture (USDA) defines food insecurity as a “household-level economic and social condition of limited or uncertain access to food.” This reality persists as one of Alabama’s (AL) most pressing public health challenges, with 11.5% of residents being food insecure and 4.4% demonstrating “very low food security.” AL’s Supplemental Nutrition Assistance Program (SNAP) recipients are faced with health implications and chronic disease due to widespread food insecurity. Nutrition incentive programs are one area of study to evaluate improving diet quality and food security status. The Gus Schumacher Nutrition Incentive Program (GusNIP) is an effort to increase fruit and vegetable (FV) consumption among SNAP recipients through AL’s Double Up Food Bucks Program (DUFB). To address these issues, this cross-sectional study examined the health and diet-related implications of DUFB AL by comparing FV consumption frequency between participants and non-participants, participation status between English and non-English speakers, and the extent to which food security, participation status, and FV consumption influence general health status. The sample size for this analysis was 4,277, which was obtained from an online-based survey for AL’s total SNAP recipients from 2022-2024 and had a 1.4% response rate. Notably, 47.8% of respondents were African American. 46.1% reported “Poor” or “Fair” health status, and only 18% have received DUFB incentives. To inform analysis, Wilcoxon signed-rank tests indicated significant differences between DUFB use and both fruit consumption frequency ($Z=-14.22$, $p<0.001$) and vegetable consumption frequency ($Z=-13.85$, $p<0.001$), with DUFB use being associated with higher reported FV frequency. Ultimately, these results indicate the efficacy of nutrition incentives to modify dietary behavior. Evaluating the effectiveness of DUFB guides future efforts to reduce food insecurity and inform AL’s first Food Systems Assessment.

Title: Environmental impact assessment of an optimized carbon dioxide capture process in a pulp and paper mill

Primary Author: Chukwuma Cyril Nwanazoba

Additional Authors: Zhihua Jiang;Selen Cremaschi;

Mentor: Selen Cremaschi

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: There is limited adoption of CO₂ capture and utilization in the pulp and paper industry, primarily due to the process's high energy requirements and the biogenic nature of these emissions, which exclude them from CO₂ emission regulations. The capture of these CO₂ emissions can move the Kraft pulp and paper industry forward towards achieving carbon neutrality, which is its unique potential compared to other industries. Moreover, the CO₂ captured in the industry has various internal and external utilization options. Our previous research on techno-economic optimization of CO₂ capture has demonstrated the economic feasibility of an optimized CO₂ capture process for the pulp and paper industry. The results from the optimized process were used in this work to evaluate its environmental impact. A cradle-to-gate life cycle analysis (LCA) was performed using the openLCA software with the ecoinvent database. This analysis covered the CO₂ capture processes for the three major emission sources in the pulp and paper industry: the bark boiler, recovery boiler, and limekiln. For each of these processes, two case scenarios were explored: the base case, in which the emitted flue gas is discharged freely without capture (S1), and the case in which the emitted flue gas is processed to capture CO₂ using the optimized capture process (S2). The environmental impact assessment methods used to analyze the results were TRACI v2.1 and IPCC 2013. The TRACI results showed significant impacts on climate change, freshwater ecotoxicity, and eutrophication, while others were negligible. For these significant impact categories, S2 had a lower (negative) impact on climate change and eutrophication, whereas S1 had a higher (positive) impact. This was corroborated by IPCC analysis, which showed all negative values for S2 and positive values for S1. However, Scenario 2 had a significant impact on freshwater ecotoxicity, attributable to the raw materials and utilities used in the capture process.

Title: First principle study of structure and property relationship of electride materials.

Primary Author: Chukwuma Ezenwata

Additional Authors: Konstantin Klyukin; Marcelo Kuroda; Evangelos Miliordos; Christopher Coger; Alexandros Androutsopoulos; Andrei Evdokimov; Valentina Nesterova;

Mentor: Konstantin Klyukin

Department/Program: Materials Engineering

College: Samuel Ginn College of Engineering

Abstract: Electrides are fascinating materials in which an electron occupies the anion position, they possess low work function and increased super-conductivity. But there is limited understanding of the tunability of electron localization in these materials, hence we are utilizing first-principle structure-properties correlation from density functional theory to understand the charge distribution, localization, tunability and structural stability of these materials. These ongoing research will guide the development of more stable electrides and improve synthesis strategies. By clarifying how structure governs functionality, we can speedily advance electride applications in energy storage, electronics and emission technologies. Moreover the expected outcome would help in the bottom-up rational design of high-performance catalysts by linking electron localization to catalytic activity due to its high ion mobility.

Title: Cotton growth with strong deer pressure

Primary Author: Claire Noble

Additional Authors: Jenny Koebernick; Kyle Hensarling;

Mentor: Jenny Koebernick

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: In recent years, the white tail deer (*Odocoileus virginianus*) has become the number one early season pest in cotton (*Gossypium hirsutum* L.) production. The pressure is costly as many fields must be replanted due to the hypocotyl being eaten which kills a cotton plant due to not being able to photosynthesize. Replanting is a serious expense for farmers as the current cost of cotton seed is close to \$900, with the latest technology. The current ways of managing the pest have been by using repellents or scarecrows and these practices are only temporary solutions as they lack the efficacy through time. Also, the current commodity price of cotton is the lowest it has been in the past decade, leaving little room for profit when you must either apply deer repellent or replant. Therefore, a deer palatability study was initiated with the objectives of determining if deer have a preference to which variety they browse on and to identify cotton native traits that either attract or repel deer. This information is critical from a genetic perspective as removing compounds from a plant or inserting them could be a more effective means of control. In 2025, 36 cultivars were evaluated for deer browsing in an 8 foot tall fenced in enclosure at the AU Deer Unit, home to 150 deer per square mile. The gates to the enclosure were opened after cotton reached the 5-leaf stage. Ratings for deer browsing were done on a 1-5 scale and taken every 7 days until all plots were eaten. Our results showed that deer demonstrated a cultivar preference, based on cultivar browsing being statistically different at different time points, however, by day 30, all the plots were completely eaten. Two prominent commercial cotton cultivars, (Phytogen 415WRF and DP 2XX) remained in all 4 plots until day 22 demonstrating that these cultivars may not be eaten as quickly as others on the market. The farming community can use this information to try planting this coming year as they are competitive cultivars. This trial will be repeated this 2026 season and exotic cotton lines with native traits will be included to investigate known defense compounds in cotton germplasm. Due to strong pressure at the AU deer unit, on farm field trials will also be conducted in 2026 to provide more realistic pressure and validate these results.

Title: Exploring design solutions for electroencephalograms

Primary Author: Claire Stovall

Additional Authors: Lauren Harding-Smith;

Mentor: Dawn Michaelson

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Long-term electroencephalogram (EEGs) testing is essential for epilepsy management, yet the cumbersome amplifier and exposed electrodes may affect patient comfort and mental health. Epilepsy patients may undergo EEG tests every 6 to 12 months, ranging from 30 min to 3 days in duration. During long term testing, patients often isolate themselves from public activities, which may reduce engagement of typical routines relevant to seizure detection. Therefore, this study aims to investigate patient experience (adult and children) during long-term EEG monitoring to inform the design of improved head coverings and equipment carriers. Through a mixed-methods survey comprising of twelve open-ended questions and Likert-type items, practicing electroencephalogram technicians, neurologists, epileptologists, and neurology nurse practitioners were asked to describe and reflect on patient experiences during EEG testing. A content analysis approach will take place to identify emerging themes. The results of this survey will inform a head covering design for the electrodes and new carrier bag for the amplifier. By understanding the limitations of covering the electrodes, such as heat, friction, proximity, and understanding the psychological distress of the EEG test, a covering design can have both positive impacts on the accuracy of EEG tests and the mental health of patients. This ongoing study advances an interdisciplinary bridge across clinical neurology, psychology, and design and provides a guide for designing for epilepsy devices.

Title: Navigating the accommodation process for reproductive events in higher education settings: Multi-stakeholder perspectives

Primary Author: Clara Ragan

Additional Authors: Regan Moss;

Mentor: Regan Moss

Department/Program: Philosophy

College: College of Liberal Arts

Abstract: Within universities, student parents face many barriers to success including inflexible attendance policies, unempathetic professors, and lack of institutional knowledge on how to seek support effectively. While accommodations can address some barriers, individuals experiencing a reproductive event in university settings report not seeking accommodations due to factors including negative interactions with faculty and staff, time poverty, and lack of support. The decision-making perspectives of people seeking accommodations are not discussed in present scholarship, and there is a dearth of information on the perspectives of accommodations facilitators. The purpose of this study was to understand how accommodations facilitators and seekers navigate the accommodations process for reproductive events and the barriers and facilitators within the process. Through semi-structured, in-depth interviews with accommodations seekers and facilitators, this study highlights the lived experiences of students who sought an accommodation for a reproductive or parenting event and explores the perspectives of those facilitating accommodations. Participants were recruited from a convenience sample utilizing snowball sampling from large 4-year universities in the southeast. Data were analyzed through mixed inductive-deductive integrated reflexive thematic analysis, utilizing the socioecological model to explicate multi-level determinants impacting decision-making. A systems-change framework was used to identify which aspects may be changed to alleviate barriers. Preliminary results reveal barriers including gaps in facilitators' understanding of their roles and responsibilities required by Title IX, inadequate education for seekers, and stigma surrounding Title IX and student pregnancy. Findings highlight opportunities for universities to better support students experiencing reproductive and parenting events through the accommodations process.

Title: Beyond sugar and acids: A comparison of rabbiteye to southern highbush blueberry quality and flavor analysis.

Primary Author: Clarisse Cochran Chipura

Additional Authors: Marlee Trandel;

Mentor: Marlee Trandel

Department/Program: Horticulture

College: College of Agriculture

Abstract: Rabbiteye (RE) and southern highbush (SHB) blueberries differ in flavor and aroma, yet sensory data for RE is limited. This study evaluated fruit quality and sensory traits of 6 genotypes: two RE advanced selections (MS1110, T-3072), two RE cultivars (Brightwell, Vernon), and two SHB cultivars (Legacy, Optimus). Fruit was harvested from E.V. Smith Research Station, transferred to the postharvest laboratory, and sorted to remove defects. Soluble solids (SSC) and titratable acidity (Tacid) were measured and trained descriptive panels (n=9) evaluated aroma, flavor, and texture at harvest and after 14 days of storage on a 15cm line scale. SSC was highest in 'Brightwell' (13.4) and lowest in 'Optimus' (10.1-9.2). Tacid was highest in RE genotypes 'Vernon', MS1110, and T-3072 (0.6-0.5, 0.6-0.4, and 0.6-0.4) and lowest in 'Optimus' (0.2-0.2). SSC: Tacid ratios were highest in 'Optimus' (43.5-47.6) and lowest in 'Vernon' (19.8-23.3). SHB had higher fruity (5.4-) and floral (3.8-) aroma intensities that declined by day 14. SHB genotypes had higher sweet (4.0) and sour (5.0) flavor traits while sourness increased during storage in RE advanced selections (4.5-7.3). SHB maintained firmness (3.0-3.4), whereas RE advanced selections became more fibrous (4.7-5.1). Among genotypes, 'Optimus' had the highest fruity aroma (6.1) and floral notes (4.5) at harvest. Overripe aroma increased in 'Vernon' (3.2-4.5) but decreased in 'Optimus' (4.6-2.7). At harvest 'Optimus' had the highest sour flavor (5.3), while MS1110 increased sourness after storage (3.9-7.3). Sweet flavor was highest in 'Brightwell' at harvest (4.6) and declined during storage. 'Optimus' was firmest at harvest (3.3), T-3072 was most seedy (7.7), and 'Legacy' increased in firmness after storage (2.7-4.0). SSC and Tacid did not fully explain sensory differences, showing flavor develops beyond sugar acid balance. RE breeding improvements appear to enhance sensory quality, but further work on volatile profiling is needed.

Title: Event as a Driver of Sustainable Development of Small Towns – A Case Study of Auburn–Opelika

Primary Author: Comfort Oye Odei

Additional Authors: Rojan Baniya;

Mentor: Baker Ayoun

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: Small towns often have limited resources, but community events can help them grow in smart and sustainable ways. This study looks at how regular events in Auburn–Opelika support the local economy, protect the environment, and strengthen community life over the long term. We will use a mix of interviews and surveys: talking with city officials, local business owners, and event organisers, and asking residents how attached they feel to their town and how proud they are of it. The study will examine how events bring in visitors and money, support small businesses, encourage the protection of local culture and history, and test eco-friendly ideas such as better waste management or clean energy showcases. Our goal is to see whether these “temporary” events can lead to lasting policies and habits that make the town more resilient and sustainable. The results will help show how festivals and community gatherings can be used as practical tools for long-term development, not just short-term entertainment.

Title: Predictors of Generalized Anxiety in College Students

Primary Author: Conner Johnston

Additional Authors: Diana Samek;

Mentor: Diana Samek

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Internalizing symptoms, such as generalized anxiety, are increasingly common among young people. This includes college students. We conducted a longitudinal study over the course of two years to identify if key factors in the first year of college (campus climate, GPA, academic burnout) predicted generalized anxiety symptoms two years later. Baseline data were collected from 195 racially/ethnically diverse first-year college students in Spring 2023 (81.0% students of color). In Summer 2025, the study collected follow-up data (n=141, 72.3% retention rate, 81.6% students of color). Multivariate linear regression was used to specify a path model with autoregressive stability coefficients. The model fit the data well. After accounting for the moderate to strong stability coefficients from baseline to two years later, campus climate, campus DEI climate, GPA, and academic burnout did not significantly predict anxiety over time. Baseline predictors and residual correlations were generally moderate-in-size and significantly different than zero. Results suggest moderate-to-strong stability in generalized anxiety and perceptions of campus climate and academic burnout in and after that first year of college. Results support early efforts to promote mental health awareness and psychoeducation of support skills in the college student population. Such efforts should likely begin long before the transition to college begins, as symptoms appear to be quite stable by the first year of college.

Title: On the Very Idea of Aesthetic Perception

Primary Author: Connor Copeland

Additional Authors:

Mentor: James Shelley

Department/Program: Philosophy

College: College of Liberal Arts

Abstract: Accounting for aesthetic experience (e.g. of artworks or natural beauty) has proved difficult for contemporary philosophers. Undeniably, such experiences are in part perceptual: they involve having seen, heard, or otherwise experienced some object in the world. From this fact, it seems natural to insist that to understand the nature of aesthetic experience we must figure out how the aesthetic figures into our standard understanding of sensory perception. Such an approach assumes that aesthetic perception must be a kind of sensory perception, like sight or smell. This narrow understanding of perception causes trouble for any account of aesthetic experience which proceeds from it. I propose that we approach the question in a new manner, motivated by recent work on the nature of aesthetic value. Some philosophers have suggested that the aesthetic must be understood as a *sui generis* domain, that aesthetic values, reasons, and responses occupy an irreducible normative-explanatory structure. Following this approach, I suggest we reject the assumption that aesthetic perception must operate within generic sensory perception and instead propose an account that does without it. An aesthetic-first approach shows how we can unify aesthetic value, judgment, and experience superior to other attempts. My approach centers considerations of value in aesthetic experience and thereby offers a new way of thinking about how the aesthetic domain is unified for both aestheticians and philosophers working on perception and experience more generally.

Title: Optimizing AAV delivery for feline GM2 gangliosidosis

Primary Author: Courtney Garrett

Additional Authors: Douglas Martin; Amanda Gross;

Mentor: Douglas Martin

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: The GM2 gangliosidoses (GM2) are a class of fatal neurodegenerative disorders resulting from a mutation in the gene encoding β -N-acetylhexosaminidase (Hex). Adeno-associated viral (AAV) gene therapy for GM2 aims to restore Hex and minimize disease progression. Although GM2 is primarily characterized as a neurodegenerative disease, it also has peripheral pathology. Therefore, successful therapy requires systemic and robust Hex expression. This study compares the effects of AAV dosage and injection route on survival and disease progression in GM2 cats. Each cohort received a low dose (LD) or a high dose (HD) via CM, IV, or combined (CM+IV) routes. For the CM+IV injections, half of the total dose was administered via each injection route. Cats were treated at 1.15 ± 0.2 months of age. Animals in each cohort were observed either for 16 weeks post-treatment or until they reached humane endpoint. 7T magnetic resonance imaging (MRI) showed delayed neurodegeneration in all cohorts. At 4 months, the typical GM2 humane endpoint, MRI and magnetic resonance spectroscopy (MRS) data for the treated cohorts correlated with delayed clinical symptoms, such as tremors and inability to stand. Ultimately, untreated GM2 cats survived 4.4 ± 0.6 months ($n=9$), CM LD cats ($n=4$) survived 9.4 ± 4.2 months, CM HD cats ($n=2$, study ongoing) survived 13.9 ± 3.4 months, CM+IV LD cats ($n=3$) survived 14.1 ± 4.4 months, CM+IV HD cats ($n=4$) survived 19.8 ± 9.1 months, IV LD cats ($n=4$) survived 8.3 ± 1.2 months, and IV HD cats ($n=4$) survived 12.4 ± 2.8 months. This study indicates that all dosages and treatment routes significantly increase the lifespan of GM2 cats and delay neurological disease progression when compared to untreated cats. The low dose for the CM+IV cohort showed superior survival in comparison to the low dose cohorts of the CM and IV-only cats. This suggests that the CM+IV combined dosing route may be most efficient at restoring Hex systemically, and, in turn, improving clinical outcomes.

Title: Season dependent performance of oat and pea mixtures compared to monocrops.

Primary Author: Cynthia Aghogho

Additional Authors: Francis Manze;Marnin Wolfe;

Mentor: Marnin Wolfe

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Farmers often grow single crops at a time which is referred to as monocropping, growing two crops together at a time in mixtures or intercropping system can improve resource use and system resilience. However, the mixture advantage depends on the right pair of crops and crop accession. Understanding how these mixtures perform compared to monocrops is limited, especially across different seasons and environments. This study compares the performance of monocrop and mixture plots and evaluates mixture response using general mixing ability (GMA) and specific mixing ability (SMA) in oat-pea system grown across multiple seasons. In this study we evaluated 12 pea and 4 oat accession performance in both monocrop and mixture plots in three different seasons (Fall 2023, Spring 2023 and Fall 2024). Data collected included crop specific dried biomass weight and growth rates of both crops. The performance of monocrop vs mixtures was compared using land equivalent ratio (LER), actual mixing effect (AME) and actual yield loss (AYL). Preliminary analysis across all three seasons, shows that mixture performance varied across seasons indicating environmental dependence for mixing ability. The LER was above 1 for both biomass and growth rate which means mixtures have advantages over monocrops. The AYL and AME revealed that these gains were driven by genotype-specific trade-offs and environment-dependent competitive dynamics for both traits. Genetic contributions from GMA and SMA were minimal in Fall 2023 and Spring 2024, but for Fall 2024 we observed a higher GMA compared to SMA (~11% GMA_pea and ~4% SMA) which means mixtures performed well on average based on the accessions used in the study. Overall, the findings from this study indicates that mixture advantages over monocrops are season- and genotype-dependent. Therefore, the right combination must be used to take advantage of intercropping systems.

Title: Integrated Air-Breathing Rotating Detonation Engine Thrust Chamber Assembly

Primary Author: Dakota Willingham

Additional Authors: David Scarborough;Ari Goldman;

Mentor: David Scarborough

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Rotating detonation engines (RDEs) are a developing interest in the propulsion community due to their enhanced burning efficiency and reduced combustion chamber length. The detonation process in the combustion chamber enhances efficiency and heat release but also increases fatigue and heat-load failures. Advanced additive manufacturing (AM) processes mitigate these issues. Traditional engines require long combustion chambers, especially at high speeds. RDEs, however, burn the propellant faster and can be shorter and lighter. Therefore, effectively designing an air-breathing RDE that avoids material failure is of interest for national defense and hypersonic flight technology. The first step was the design of the annular combustion chamber based on other subscale RDEs. The target operational condition above 100 psi was chosen. The engine was designed to integrate with the flow system in place at the Auburn University Combustion Physics Lab (AUCPLAB). Injector configuration and the sizes of the fuel and air orifices were then selected, where orifice shrinkage after printing had to be accounted for. The outer body was designed with an air bypass ratio that enables thermal steady state survival. NASA heat flux models were used to find the number of coolant channels and the shape of the channels in the bypass. The coolant channels maximize cooling efficiency while maintaining axial entrance and exit flow. The manifold was designed for uniform pressure distribution to the injector. The manifold also included acoustic cavities that promote a target fundamental frequency in the chamber to force the designed chamber condition and number of waves. The entire engine is AM, and therefore, the design required printability considerations. The parts were printed out of a NASA superalloy, and the necessary machining was performed. The engine was then tested at the AUCPLAB, and the performance data and operational conditions were compiled for comparison to existing data.

Title: Tuning Memristive Behavior in Single-Crystal Transition Metal Dichalcogenides via Interpretable Machine Learning.

Primary Author: Dakotah Kirk

Additional Authors: Marcelo Kuroda;

Mentor: Marcelo Kuroda

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Memristors are electronic devices with non-volatile resistance states that have recently been demonstrated in two-dimensional transition metal dichalcogenides (TMDs). In single-crystal systems such as MoSe_2 and WSe_2 , we attributed the memristive switching to an insulator-to-metal transition facilitated by the electrodes and stabilized by defect binding. Yet, understanding how different electrode materials influence phase stability across a broader range of TMDs remains an open challenge. In this work, we present a systematic framework for rationalizing and engineering memristive behavior in group-VI TMDs (MoS_2 , WS_2 , MoSe_2 , and WSe_2) interfaced with transition-metal electrodes. Using high-throughput first-principles calculations within density functional theory and machine learning trained inter-atomic potentials, we examine trends in phase stability as a function of electrode chemistry, dielectric environment, and defect energetics. Machine learning analysis is employed to extract physically meaningful structure–property relationships from this combinatorial dataset, enabling identification of the key material parameters that promote stable and reversible switching. Overall, this work provides design principles for selecting electrode–TMD combinations with optimal memristive performance.

Title: Hot birds: Evaluating acute heat stress responses in zebra finches

Primary Author: Danica Vo

Additional Authors: Margaret McGrath; Ben Haussmann;

Mentor: Haruka Wada

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: As global temperatures continue to rise, individual and population differences in response to heat stress may impact who will survive and reproduce. It is critical to understand the variation in physiological responses to heat stress to help predict population levels of species and extinction risks. Because females are found to be more susceptible to heat, a decline in females due to heat damage can disproportionately impact reproductive rates and lead to a population decline. This study aimed to understand how acute heat exposure affects the physiology of zebra finches (*Taeniopygia guttata castanotis*) in males and females, specifically in DNA and ketones. Individuals were assigned to either a control (22°C) or a heated treatment (43°C). The birds were acclimated in an incubator for three days prior to being exposed to the heat treatment for five hours. We monitored body temperature using PIT tags and collected pre- and post-treatment blood samples to measure glucose, ketones, and DNA damage. DNA was extracted from red blood cells using a modified Qiagen PureGene Kit protocol and analyzed using the Repair Assisted Damage Detection (RADD) assay. Our results revealed that acute heat exposure led to a significant rise in both glucose and ketones. The RADD analysis provided no significant evidence of DNA damage due to heat stress. Furthermore, no significant sex differences were observed between these variables. The elevation of glucose and ketones suggests that these birds are using multiple fuel sources to meet the demands of high metabolism in hot environments. While we were surprised to find no DNA damage after heat exposure, it is possible that ketones and other antioxidants prioritize maintaining DNA integrity. Sex-specific physiological responses are critical to predict and prevent potential population instability. Understanding these defense mechanisms is vital for predicting how species will survive an increasingly warming climate.

Title: The Effect of Count Context on Swing Speed and Kinematics in Division 1 Baseball Hitters

Primary Author: Daniel Woodham

Additional Authors: Gretchen Oliver; Ryan Zappa; Ian Jump;

Mentor: Gretchen Oliver

Department/Program: School of Kinesiology

College: College of Education

Abstract: In baseball, a batter's approach may vary depending on the count in the at-bat, specifically in a hitter's versus a pitcher's count. Batters may adopt a more aggressive approach when ahead in the count or a more conservative one when behind, potentially altering swing speed. Understanding how batters alter swing speed and other kinematic parameters may help coaches improve hitting performance. However, this is theoretical and has not been assessed empirically. The purpose of this study was twofold: (1) to examine the relationship between count and max swing speed, and (2) if a difference was observed between max swing speed and count, kinematics between counts would be investigated. In-game kinematic data (segment positions, velocities, and joint motions) were collected on 43 D1 collegiate hitters ($1.8 \pm 0.08\text{m}$, $91 \pm 8\text{kg}$) using a KinaTrax markerless motion capture system (300Hz). Max swing speed, hip-shoulder separation (HSS) and forward center of mass velocity (COMV) (toward the pitcher), were extracted for analysis. Participants' inclusion required a minimum of 3 swings in a hitter's count and 3 swings in a pitcher's count. A hitter's count was defined as 2-0, 3-0, or 3-1, and a pitcher's count was defined as 0-2 or 1-2. Only swings associated with fastballs were included. Three separate paired-samples t-tests were used to compare maximum swing speed, COMV, and HSS across counts. Swing speed ($p < .001$, $d = 1.39$), COMV ($p < .001$, $d = .921$), and HSS ($p < .014$, $d = .392$) were greater in the hitter count condition compared to the pitcher count condition. These results suggest that swing speed differs based on batter count. Moreover, the studied kinematics differed by count, suggesting that these variables may be influencing the observed difference in swing speed. The study's findings could provide coaches with strategies for adjusting a batter's approach based on the count to improve performance. Future research should examine how approach changes influence offensive performance.

Title: Correlation Between Antimicrobial Activity and Fungal Resistance Across Ant Species

Primary Author: Daniel Yuan

Additional Authors: Clint Penick; Darmon Kahvazadeh;

Mentor: Clint Penick

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Social insects such as ants live in dense colonies that experience a high risk of pathogen transmission, creating strong selective pressure for the evolution of antimicrobial defenses. Ants can produce diverse antimicrobial compounds through a variety of glands. Certain ant species possess antimicrobial compounds that have proven effective in the inhibition of bacterial growth. However, the antifungal properties of antimicrobials across ant species have remained largely unexplored. We investigated the variation in antifungal potency of antimicrobial extracts from multiple ant species to determine if species differ in their ability to inhibit fungal growth. We collected workers from several key ant species that can be found across Alabama. Antimicrobial compounds from these ants were then extracted using ethanol and tested for antifungal activity against the yeast *Saccharomyces cerevisiae* using liquid growth assays in 96-well plates. Fungal growth was quantified via optical density measurements at 600 nm over a 24-hour incubation period. Inhibition was determined by looking at differences between optical density readings between treatment groups, *Saccharomyces* treated with antimicrobials, and control groups, *Saccharomyces* without antimicrobials. We predicted that antimicrobial extracts would differ significantly in antifungal potency among ant species, reflecting variation in chemical composition driven by ecological and evolutionary factors. Identifying interspecific variation in antifungal activity may help narrow candidate taxa for future studies of antifungal compounds. This work contributes to understanding the evolution of social immunity in ants and highlights social insects as promising sources of novel antifungal agents in the context of rising antifungal-resistant pathogens.

Title: Modulation of right frontal eye field functional connectivity using rTMS: A study of high risk drinkers and healthy controls

Primary Author: Darienne Jefferson

Additional Authors: Samantha Fede;

Mentor: Samantha Fede

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Attention biases towards alcohol content may contribute to risky drinking behaviors and alcohol use disorder. The frontal eye field (FEF) aids in attention modulation and may influence attention biases through functional connections across the brain. Prior research suggests that repetitive transcranial magnetic stimulation (rTMS) modulates the FEF and attention modulation, but there is a need to understand whether downstream connectivity can also be modulated. High-risk drinkers (HRDs; $n=17$) and healthy controls (HCVs; $n=16$) completed a three-session study (baseline and two 30-minute rTMS sessions targeting the right FEF; 10Hz/1Hz, counterbalanced). Sessions included a resting state fMRI scan (10 minutes, fixation cross). Functional connectivity analyses were performed using Matlab's CONN toolbox. Specifically, Seed-to-Voxel analyses were conducted using the stimulation location (right FEF) as the seed, controlling for age and sex. Results were thresholded at voxel-wise $p<0.001$ and cluster-wise $pFDR<0.05$. Across subjects, connectivity decreased from baseline following 10hz rTMS between the FEF seed and the precuneus brain regions. HRDs (compared to HCVs) had a greater increase from baseline in FEF connectivity with the left intraparietal sulcus after 1hz rTMS, but less differentiation between rTMS conditions in connectivity between the FEF and the dorsolateral prefrontal cortex brain regions. Excitation of the right FEF produced limited effects on connectivity, but there was a significant influence of alcohol consumption on this perturbation, suggesting a potential connection to attention biases. Future analysis will examine rTMS impact on FEF connectivity during an alcohol-dot probe style task to assess the role excitation may play in alcohol-related attention biases.

Title: Ant Defenses and Disease: Do antimicrobial investments across ant species predict vulnerability to fungal entomopathogens?

Primary Author: Darmon Kahvazadeh

Additional Authors: Clint Penick; Daniel Yuan; Alice Raybosh;

Mentor: Clint Penick

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Social insects live in dense, highly interactive colonies where the risk of disease transmission is much higher than in solitary animals. To mitigate this risk, ants employ a range of external immune defenses, including antimicrobial compounds that prevent infection following pathogen exposure. However, not all ant species invest in external antimicrobial defenses and may instead rely more heavily on internal immune mechanisms. Here, we tested whether ants that vary in external antimicrobial investment differ in their susceptibility to entomopathogenic fungi. First, we compared multiple strains of the generalist entomopathogenic fungus *Beauveria bassiana* against the red imported fire ant, *Solenopsis invicta*. We then selected the most virulent strain and conducted a cross-species comparison across several ant species exposed to six concentrations of *B. bassiana*. We predicted that species investing in external antimicrobials would show greater resistance at low pathogen doses but would be overwhelmed at high doses relative to species lacking such investment, which we expected to be comparatively more resistant at high doses due to higher investment in internal defenses. Our results showed that ant species do vary broadly in their pathogen susceptibility, but this was not related to antimicrobial investment. We further examined additional traits, including body size and cuticle thickness, and found support for an effect of body size but not cuticle thickness. These results suggest that factors other than external antimicrobial investment shape ant susceptibility to fungal pathogens.

Title: Upcycling nutrients from poultry manure using black soldier fly larvae bioconversion

Primary Author: Dative Niyonizeye

Additional Authors: John Linhoss;Brendan Higgins;Saravanan Ramiah Shanmugam;

Mentor: Saravanan Ramiah Shanmugam

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Poultry manure management poses significant environmental challenges due to nutrient runoff, odor emissions, and excess nitrogen and phosphorus loading, particularly in major poultry-producing regions such as Alabama. This state has approximately 2,775 poultry producers, ranks second in U.S. broiler production at about 22 million birds processed per week, and generates an estimated 3.6 billion pounds of poultry litter annually. Black soldier fly larvae (BSFL) bioconversion offers a sustainable approach to upcycle poultry manure into value-added products such as insect protein and nutrient-rich frass; however, poultry manure alone often results in poor larval performance due to imbalanced nutrition and high ammonia levels. This study investigated the effect of blending post-consumer food waste, collected from our AU Campus dining facility (The Edge), with poultry manure as a co-substrate to improve BSFL bioconversion efficiency. A 14-day feeding experiment was conducted using five substrate ratios (dry weight basis): 100% poultry manure, 75% poultry manure/25% food waste, 50% poultry manure/50% food waste, 25% poultry manure/75% food waste, and 100% food waste. Seven-day-old BSFL were reared at controlled density and moisture conditions, with peanut hulls added to maintain the substrate moisture. Performance was evaluated using feed conversion ratio (FCR), bioconversion efficiency (BCE), waste reduction, larval biomass composition, frass characteristics, and carbon and nitrogen mass balances. Larvae fed 100% poultry manure exhibited poor growth and inefficient substrate utilization. In contrast, co-digestion with food waste significantly improved bioconversion metrics in a dose-dependent manner. The 50:50 poultry manure–food waste blend achieved the highest nitrogen (14.9%) and carbon (16.8%) assimilation among poultry-manure-containing treatments, with FCR values comparable to food-waste-only controls. These results demonstrate that food waste co-digestion enhances BSFL bioconversion of poultry manure, supporting its potential for sustainable waste management and resource recovery. **Keywords:** Poultry manure, BSFL, Upcycling nutrients, Ammonia inhibition, Bioconversion

Title: Cadmium's toxic effect on brown adipocyte differentiation and thermogenic gene expression

Primary Author: David Ro

Additional Authors: Michkayla Prince; Vorrashin Souriya;

Mentor:

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Cadmium (Cd) is a persistent environmental toxicant known to disrupt cellular metabolism, yet its effects on thermogenic adipocytes remain incompletely understood. We examined the metabolic consequences of Cd exposure in WT-1 mouse brown adipocytes, a metabolically active cell essential for systemic energy balance. In brown adipocytes, chronic exposure to 10 μ M Cd markedly inhibited lipid accumulation, impaired differentiation, and nearly abolished expression of the thermogenic gene uncoupling protein 1 (UCP1). In contrast, low-dose Cd (1 μ M) caused minimal disruption and even increased UCP1 expression during short-term exposure, suggesting a limited adaptive response to mild stress conditions caused by toxic heavy metal. These results demonstrate a dose-dependent loss of thermogenic function and adipogenic gene expression, indicating Cd can compromise lipid metabolism by disrupting adipocyte maturation. Taken together, these findings show that exposure to heavy toxic metal induces dysfunction of lipid metabolism and thermogenesis in brown adipocytes. In the future, we will be investigating the underlying molecular mechanism of how Cd affects brown adipocyte mitochondrial function and adipokine secretion as further studies.

Title: Unrecognized and declared: the Islamic State and conceptions of statehood

Primary Author: David Walker

Additional Authors: Matthew Clary;

Mentor: Matthew Clary

Department/Program: Political Science

College: College of Liberal Arts

Abstract: At its territorial height around 2015, the Islamic State posed a unique problem to international law and the international system by challenging prevailing conceptions of statehood. This project examines how existing theories of statehood, including the declaratory and constitutive frameworks, conceptualize the peculiar position of the Islamic State. Building upon existing literature, this paper evaluates the Islamic State as a case study to find where it fits within theories of statehood. We argue that the Islamic State failed to achieve statehood, despite satisfying the four criteria of the Montevideo Convention. This suggests that contemporary views of statehood are returning to more traditional constitutive conceptions by emphasizing peremptory norms (standards of state behavior that are commonly held to be non-derogable) over territorial effectiveness (the degree to which an entity exercises its authority over a territory). The value of this research is two-fold. First, it contributes to existing scholarship on legal and normative conceptions of what constitutes a state in international relations. Second, it clarifies the strategic and normative significance of how differing designations of statehood are used. In doing so, it provides better guidance for conceptualizing such entities both in the present and future.

Title: Emergence and spread of the Two-Spot Cotton Leafhopper in Alabama in 2025

Primary Author: Dawson Park

Additional Authors: Scott Graham;Alana Jacobson;Giovani Rossi;

Mentor: Alana Jacobson

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The two-spot cotton leafhopper, *Amrasca biguttula* (Hemiptera: Cicadellidae) (Ishida, 1913) recently emerged as a pest in the southeastern United States. During the 2025 growing season, coordinated scouting was conducted across Alabama in commercial fields, experimental trials, and three sentinel plots established at research stations. Monitoring frequency and scouting precision differed among efforts, with sentinel plots representing the most systematic approach. Weekly monitoring using vacuum sampling, sweep netting, and yellow sticky traps enabled early detection and quantification of local population dynamics. *Amrasca biguttula* was first detected in Alabama on June 17 and June 19 in sentinel plots in Shorter and Headland, respectively, and subsequently in Brewton on July 22. In contrast, detections in commercial fields and experimental trials occurred later, beginning August 13. Following initial detection in production fields, this pest was rapidly observed across the state. The number of confirmed counties increased from nine on August 22 to 24 by September 9, and reached 38 by September 19. Populations within sentinel plots remained low for several weeks before increasing sharply in mid-August, consistent with localized population buildup. Earlier detection in sentinel plots relative to commercial fields indicates that *A. biguttula* was likely present across multiple locations prior to being observed in production systems. These findings highlight the value of intensive early-season monitoring and suggest rapid within-season dispersal. Future efforts should focus on determining the environmental and spatial drivers of spread to strengthen prediction, monitoring, and response capacity where this invasive pest becomes established.

Title: Dielectrophoretic Motion and Assembly of Janus Liposomes

Primary Author: Debneela Paul

Additional Authors:

Mentor: Wei Zhan

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Liquid-liquid phase separation in cell membranes has been increasingly recognized as a general guiding principle in cellular organization and functions, to which lipid systems with well-defined phase relationships continue to serve as useful models to decipher the structure and dynamics involved. However, direct experimental strategies that can non-invasively probe the dielectric and interfacial properties of coexisting membrane phases under dynamic electric fields remain limited. In this work, we subject micro-sized liposomes in either liquid-ordered or liquid-disordered phases, or in coexistence under AC dielectrophoresis, and quantitatively resolve their field-driven motion and assembly, phase-dependent polarization, and dielectric response using fluorescence microscopy. Several salient trends have emerged from this systematic investigation, including liposome accumulation, pearl-chain formation, size-based sorting, levitation, reversible shape transitions, self-rotation, and phase-specific alignment perpendicular to the applied electric field. These unique liposome responses arise within discrete, frequency-dependent windows across the AC spectrum tested (10 Hz–30 MHz). Together, these results demonstrate dielectrophoresis as a mechanistically informative platform for resolving phase-dependent interfacial dielectric properties in heterogeneous lipid membranes under dynamic electric fields, providing a quantitative framework for interrogating membrane phase coexistence and electrostatic heterogeneity.

Title: Interaction of ESR1 mRNA with microRNA 18a and 19a in canine mammary tumor cells

Primary Author: Deepika Goyal

Additional Authors: Richard Bird;

Mentor: Richard Bird

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Breast cancer is among the most prevalent malignancies in humans. Canine models are valuable for comparative studies of breast tumors due to their spontaneous tumor development and shared molecular and hormonal characteristics with human breast cancer. Loss of estrogen receptor 1 (ER1) in mammary tumors is associated with increased aggressiveness and poor prognosis in both species. Recent evidence suggests that small non-coding RNAs, microRNAs (miRNAs), may regulate the expression of ER1 in breast cancer. We have previously shown that miR-18a and miR-19a are upregulated in canine mammary tumors (CMTs). Based on these findings, we propose that miR-18a and/or miR-19a may modulate ER1 expression in breast cancer, affecting its neoplastic potential. Bioinformatic analyses predict that these miRNAs may bind to the ESR1 3' untranslated region (UTR), although experimental validation in CMTs is currently limited. To validate our predictions, we measured ER1 mRNA, miR-18a, and miR-19a levels using quantitative real-time PCR (qRT-PCR) in various cell lines from our lab, including CMT12, CMT27, CMT28, and CMT47, and normal epithelial cells (validated by sequencing). We then performed co-transfections with ER1 3' UTR reporter constructs containing Gaussia luciferase, and secreted embryonic alkaline phosphatase, along with vectors expressing either miR-18a or miR-19a tagged with green or red fluorescent proteins as reporter genes, and/or anti-miR oligonucleotides. Luciferase activity was measured to assess direct miRNA–target interactions. Gaussia luciferase activity decreases by at least 30% upon miRNA transfection. In contrast, anti-miR co-transfection restores activity to nearly control levels, confirming the miRNA's knockdown effect on the target gene. Luciferase reporter assays have confirmed that miR-18a and miR-19a directly target the ER1 gene, underscoring differences in ER1 expression between breast cancer cells and normal cells. Further levels of mRNA and protein of ER1 will be measured using quantitative real-time PCR (qRT-PCR) and Western blot techniques after transfection with either miRNA vectors or anti-miRNA oligonucleotides. This investigation will also examine how the suppression of ER1, driven by miRNAs, affects critical processes, including cell proliferation, migration, and invasion. In summary, these insights enhance our knowledge of miRNA-mediated control of ER1 and its impact on tumor development, paving the way for new therapeutic approaches.

Title: Hookup culture on sexual behavior and relationships

Primary Author: Deniscia Rankine

Additional Authors:

Mentor: Brian Gillis

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: With the rise of casual dating and hookup culture, people are forgoing more committed and intimate relationships in favor of engaging with others at a more superficial level, as such behavior is more socially accepted. This tradeoff has implications for sex and relationships regarding behavior and beliefs, which specifically go against commonly held desires for these sectors. This topic evaluates trends specifically among young, college-aged adults and their behaviors related to their well-being. This phenomenon was examined through a theoretical inquiry, drawing on recent studies of hookup culture and casual dating. This exploration uncovered that dating app usage predicted more favorable attitudes toward sexual permissiveness and instrumentality, increased relationship anxiety, relationship avoidance, and less favorable views on birth control (Dai, 2021), casual sex predicted less favorable attitudes toward sexual intimacy (e.g., believing "sex is meaningful") (Katz & Schneider, 2013), and men and women express positive feelings if climax occurs, but negative feelings if it does not, highlighting performance pressure (Quinn, 2024). This reveals a stark gap between intended outcomes and behaviors that inhibit these desires, driven by cultural pressures.

Title: The Use of Non-Invasive Brain Stimulation in Music Cognition: A Systematic Review

Primary Author: Denisen Justice

Additional Authors: Samantha Fede;

Mentor: Samantha Fede

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Music cognition is an interdisciplinary field investigating how humans perceive and produce music, with additional focus on neurological conditions like amusia. Non-invasive brain stimulation (NIBS) techniques allow for causal relationships to be drawn between brain activity and behavior and further offer potential novel treatment pathways. Although previous literature has reviewed the use of NIBS in auditory processing generally, there has been no systematic review of the use of NIBS in music cognition. This review was conducted following the Prisma 2020 Checklist framework and preregistered on OSF. A database search was conducted for reports of empirical studies using NIBS to investigate music cognition (prior to 8/11/2025). Of the 2,953 unique sources initially identified in database search, only 83 met the initial inclusion criteria. An additional 44 were excluded due to focus on motor evoked potentials rather than music cognition. We synthesized the remaining 39 sources in depth, extracting study characteristics including the music cognition domain investigated, the stimulation site/parameters, and the result of NIBS. Four major categories of music cognition domains emerged: pitch perception, rhythm perception, aesthetic perception, and performance. Pitch perception has been most modulated through prefrontal, parietal, and temporal stimulation. Rhythm perception and performance have been most modulated through motor and parietal area stimulation. Aesthetic processing is modulated by both prefrontal and motor stimulation. Results reinforce models of dissociable music cognition processes for pitch and rhythm. Given the specific pitch perception deficits in conditions like amusia, this suggests candidate targets for NIBS based interventions in the future.

Title: Vascular injury from Açai–Methotrexate interactions: Mechanistic evidence from endothelial cell models

Primary Author: Destini Thornton

Additional Authors: Angela Calderon; Jianzhong Shen; Roser Badia Rivero;

Mentor: Angela Calderon

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Breast cancer survivors frequently use botanical dietary supplements (BDS), such as açai (*Euterpe oleracea*, Mart.), alongside chemotherapy to improve quality of life; however, adverse cardiovascular events have been reported when açai is combined with non-CYP3A4-metabolised anticancer drugs. Previous in vitro studies demonstrated that açai enhances methotrexate (MTX) toxicity in non-tumorigenic breast epithelial cells resembling normal cells in a breast cancer model, suggesting off-target toxicity and raising concerns for vascular injury. Building on these findings, this study investigated the mechanistic vascular effects of açai–MTX combinations. Standardized açai fruit powder extracts and commercial açai BDS were evaluated for toxicity and vascular disruption using human umbilical vein endothelial cells (HUVECs). Endothelial cell viability was assessed via resazurin assay, and drug–supplement interactions were quantified using SynergyFinder Plus. Nitric oxide (NO) production and angiogenesis assays will be used to evaluate endothelial dysfunction and vascular injury. Published breast cell data demonstrated additive to synergistic toxicity from açai–MTX combinations, with the highest synergy and necrotic signalling observed in non-tumorigenic cells, providing a rationale for endothelial investigation. In endothelial cells, açai–MTX combinations are expected to produce enhanced toxicity relative to single treatments, accompanied by disrupted NO signalling and impaired angiogenic capacity, indicating vascular injury as a potential mechanism underlying reported cardiovascular adverse events. These findings demonstrate that açai–MTX combination can induce vascular injury, providing mechanistic insight into reported adverse cardiovascular outcomes and highlighting the need for evidence-based guidance on the concomitant use of botanical supplements and chemotherapy.

Title: Enhanced channel catfish virus resistance via alligator cathelicidin transgene in *Ictalurus punctatus*

Primary Author: Dhanuka Bambaranda Hewage

Additional Authors: Timothy Bruce; Rex Dunham; Jinhai Wang; Darshika Udari Hettiarachchi; Kate Pottle; Misha Soman; Mei Shang; Baofeng Su; Ahmed Elewa Shaaban; Nadeen Abdo;

Mentor: Rex Dunham

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Channel catfish virus (CCV) is one of the most devastating pathogens affecting channel catfish (*Ictalurus punctatus*) fry and fingerlings, often resulting in rapid and extensive mortality. Current mitigation approaches rely on biosecurity and husbandry practices, since antibiotics and medicated feeds are not effective against CCV. Here, we evaluated a long-term, sustainable genetic approach to enhance antiviral resistance in channel catfish using transgenesis. An alligator-derived cathelicidin (Cath) gene was integrated into the channel catfish genome using CRISPR/Cas9-assisted microinjection. First-generation (F₁) fingerlings derived from cathelicidin-positive (Cath⁺) parents were used in a controlled, blinded CCV challenge. Three replicated genetic groups were evaluated: (1) all Cath⁺ families (inheritance rate 90%), (2) Cath⁺ hybrid families (inheritance rate 45%), and (3) non-Cath families (inheritance rate 0%) carrying desaturase transgenes. In each genetic group, three replicates were used, and ten fish per replicate were randomly selected, housed in mesh cages within a recirculating system, and challenged with CCV at 2.32×10^6 CFU mL⁻¹ via a 1-hour static immersion. Cumulative percent mortality (CPM) differed significantly among genetic groups (one-way ANOVA: $p = 0.0014$, $F = 23.74$, $R^2 = 0.8878$). All Cath⁺ families exhibited significantly lower mortality (76.7%; $p = 0.0024$) than both Cath⁺ hybrid and non-Cath families, which experienced 100% mortality. Transgene inheritance was confirmed post-challenge by polymerase chain reaction (PCR), and all surviving fish in all Cath⁺ families carried the cathelicidin transgene in their genome. Collectively, these results indicate that cathelicidin transgenesis significantly improves CCV resistance in channel catfish and offers a viable long-term approach for enhancing aquaculture sustainability.

Title: Radar-Camera Joint Calibration for Room Scanning and Material Recognition

Primary Author: Dhimitri Petro

Additional Authors:

Mentor: Zihe Gao

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: Spatial calibration is a critical requirement for multi-sensor systems that combine diverse sensing modalities into a unified framework. Specifically, integrating a mmWave radar with a depth-sensing camera enables enhanced perception capabilities. Establishing a joint Radar-camera calibration pipeline is critical for accurate spatial alignment between multimodal data and accurate scene understanding, and provides a foundation for future research in this area and the ultimate goal of developing optimized room layouts for efficient wireless signal distribution. While camera calibration is a well-established process, calibrating radar sensors with cameras presents additional challenges due to differing measurement principles and the lack of shared visual features. Existing approaches often rely on specialized calibration targets and are designed for large-scale platforms, such as those used in automotive systems. To address these challenges and create a flexible pipeline tailored for our hand-held room-scanning system, a radar-camera calibration pipeline was developed using a ChArUco board, custom 3D-printed radar corner reflectors, and a mmWave radar sensor mounted with a depth-sensing camera. Camera intrinsics were estimated through ChArUco corner detection across diverse views. Radar point clouds were processed to detect corner reflectors corresponding to known board geometry. These measurements were then used to compute a rigid transformation defining the spatial relationship between the radar and camera coordinate frames. The final calibration pipeline consistently produced a stable extrinsic matrix across multiple capture viewpoints. Reprojection of radar-detected corner reflectors into the camera image plane demonstrated strong spatial alignment and confirmed the accuracy of the estimated calibration. This work provides a reliable joint radar-camera calibration framework for future room-scale sensing applications.

Title: Influenza Hemagglutinin Computationally Optimized Broadly Reactive Antigen (COBRA) Vaccines Delivered Intranasally in Pigs Offer Broad Mucosal and Cell Mediated Immune Responses and Protection Against Challenge

Primary Author: Dimitrios Sakkas

Additional Authors: Constantinos Kyriakis; Maria Naskou; Alyona Michael; Trinity Beell; Camryn Mattox; Fletcher North; Alik Kalpourtzidou; Diego Ernesto Ventura Urbina;

Mentor: Constantinos Kyriakis

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Influenza A virus (IAV) infections are among the leading causes of respiratory disease in humans. Annual vaccination is our main tool used to mitigate disease, and vaccine formulation is based on the antigenicity the hemagglutinins (HA) H1 and H3 surface glycoproteins. Vaccine strains are updated every year, based on the surveillance data. However, depending on the flu season, vaccine efficacy can be as low as 19% due to the ability of the virus to acquire mutations and change its antigenicity. A promising approach for better “universal” vaccines is the Computationally Optimized Broadly Reactive Antigen (COBRA) methodology, which expands the protective potential of the vaccine by designing HA antigens with conserved epitopes. Achieving efficacious protective immune responses after vaccination can also be significantly influenced by adjuvant selection and vaccination administration route. Our team evaluated the efficacy of adjuvanted COBRA H1 and H3 antigens intranasally (IN) in the porcine model across three studies. In the first study, we compared the effectiveness of an intramuscular traditional vaccine with seasonal HAs against the novel COBRA HAs synthesized with different TLR agonists as adjuvants. Following viral challenge, pigs vaccinated with COBRA HA and TRAC-478, a combination of TLR4 and TLR7/8 agonists as mucosal adjuvants, showed strong cell-mediated immunity (CMI) responses, broad systemic and mucosal immunity with high nasal IgA titers. These responses correlated with the lowest virus titers in the respiratory tract. The subsequent two studies demonstrated that, even in the absence of detectable systemic antibodies, pigs receiving IN COBRA HAs formulated with TRAC-478 showed reduction of viral loads and enhanced CMI responses following challenge with two viral strains (H1N1 and H3N2). These results highlight the potential of IN delivery of COBRA vaccines with novel adjuvants as a promising strategy for the design of next-generation vaccines.

Title: Drinking for enhancement and out of routine impacts AUDIT scores: an ecological momentary assessment across social and binge drinking groups

Primary Author: Dorothy Dreelin

Additional Authors:

Mentor: Sara Blaine

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Drinking motives, particularly drinking to cope and for enhancement, have been linked to higher alcohol consumption and related consequences which can lead to alcohol use disorder. As such, drinking motives have become a widely recognized treatment target for mental health providers across numerous settings. In the current study, motives among social and binge drinking groups (SD and BD) were examined using ecological momentary assessment (EMA) to better understand how coping, conformity, enhancement, social, and routine (i.e., drinking out of habit and out of boredom) motives impact hazardous alcohol use patterns across a 30-day period. Participants were a mix of college students and community members between ages 21-45 ($n = 57$, $M_{age} = 26.67$, $SD_{age} = 6.53$, 52.6% male, 84.3% Caucasian). Multiple linear regressions were conducted examining the relationship between the proportion of motives endorsed throughout the EMA period and Alcohol Use Disorder Identification Test (AUDIT) scores collected at intake. Results revealed a significant direct effect such that routine motives were positively associated with AUDIT scores across groups ($B = .678$, $SE = .247$, $p = .008$). A significant interactive effect emerged demonstrating a positive association between enhancement motives and AUDIT scores among the BD group ($B = .957$, $SE = .437$, $p = .033$). These findings suggest routine motives are a potential marker of hazardous use regardless of binge drinking status. Our results highlight the risks associated with binge drinking for enhancement effects specifically. Providers should comprehensively assess for routine motives in addition to more well-established motive categories of coping, conformity, social, and enhancement. Harm reduction strategies for routine and other hazardous motives can then be implemented or used preventatively especially among young adults. Future research should regularly examine routine motives as an emerging and understudied motive category.

Title: Meta-analysis of RNA-Seq and Ribo-Seq datasets in RQC deficient strains.

Primary Author: Douglas Wright

Additional Authors:

Mentor: Alexey Petrov

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The ribosome is a macromolecular machine, which translates an mRNA transcript into a polypeptide. During translation, the ribosome sequentially reads mRNA in the 5' to 3' direction, decoding codons and building the polypeptide. Eukaryotic mRNAs are commonly modified in 5' Untranslated Region (UTR), the reading frame, and the 3' UTR. These modifications are dynamic and modulate protein expression. The roles of these modifications and how they regulate protein synthesis remains poorly understood. Previous work showed that m6A, o8G and other modifications stall translating ribosomes. The stalled complexes are recognized by Ribosome Quality Control (RQC) pathways that rescue stalled ribosomes and degrade aberrant mRNAs. The range of modifications and mRNAs that are regulated through such mechanisms are likely larger than identified. To test this hypothesis, we are conducting a meta-analysis of twenty-nine published RNA sequencing (RNA-seq) and ribosomal sequencing (Ribo-seq) datasets in wild type and RQC response deficient strains of *Saccharomyces cerevisiae*. Cross correlation with mRNA modification datasets will reveal what modifications and mRNAs are regulated by RQC pathways. Currently, twenty-seven Ribo-seq files have been aligned to a reference genome. The results from this study will be used to determine which in vitro experiments analyzing mRNA modification effects on ribosomes in real-time to perform.

Title: Effectiveness of Silver Diamine Fluoride Targeting Dental Caries in Children: A Review of the Literature

Primary Author: Dylan David

Additional Authors:

Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Dental caries remains one of the most prevalent chronic conditions affecting children, with disproportionate burden among underserved and low-income populations. Silver diamine fluoride (SDF) has emerged as a minimally invasive, cost-effective intervention for arresting dental caries in pediatric populations. While early studies focused on lesion arrest, recent research has expanded to assess clinical effectiveness, patient-centered outcomes, and access to care. This scoping review evaluated peer-reviewed studies on SDF for caries management in children aged 2–12 years. A systematic search of PubMed, CINAHL, and Google Scholar was conducted for studies published between 2020 and 2026. Inclusion criteria encompassed clinical trials, cohort studies, and observational studies reporting caries arrest rates and treatment outcomes; studies limited to adults, laboratory analyses, or lacking quantitative outcomes were excluded. 12 studies met inclusion criteria, with study quality and risk of bias assessed descriptively using the Cochrane risk-of-bias tool. Findings revealed four main themes: (1) clinical effectiveness, with caries arrest rates ranging from 58.4% to 82.1%, often outperforming conventional restorations in primary teeth; (2) improved feasibility and access in community and school-based settings; (3) caregiver and provider acceptability, primarily influenced by tooth discoloration; and (4) cost-effectiveness, with SDF demonstrating lower per-tooth treatment costs, on average four times less than conventional care, particularly when avoiding sedation or general anesthesia. Overall, SDF represents an effective, minimally invasive strategy for pediatric caries management. Future research should examine standardized outcome reporting, longitudinal follow-up beyond 24 months, and integration of SDF into school-based and public health oral health programs.

Title: Air flow versus pressure drop through a packed bed of pine residue and municipal solid waste at different moisture content: a revised Ergun correlation

Primary Author: Edith Laure Yonguep Ngoupeyou

Additional Authors: Sushil Adhikari;Oladiran Fasina;

Mentor: Oladiran Fasina

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Thermochemical conversion of pine residues and municipal solid waste (MSW) presents a promising pathway to reduce reliance on fossil-derived energy, alleviate energy demand, and minimize environmental impacts. Fluidized beds are widely employed for converting these feedstocks because they provide excellent mixing, high heat and mass transfer rates, and uniform temperature distribution, conditions that enhance reaction efficiency and product yield. Effective operation of fluidized beds depends heavily on accurate estimation of pressure drop. The Ergun correlation is traditionally used to represent kinetic and viscous energy losses caused by airflow resistance in fluidized beds and has proven reliable for uniform particles. However, fails to accurately predict pressure drop for non-uniform particles with broad size distributions and high moisture content (MC), such as biomass materials. Consequently, modifications are required to account for the unique characteristics of pine residues and MSW. New correlations were developed to estimate the pressure drop of pine residues and MSW at varying moisture contents by incorporating particle shape and the coefficient of variation (CV) to represent particle size heterogeneity. Results showed that bulk and particle density, and porosity of both materials were significantly influenced by increasing moisture content ($p < 0.05$), while the CV decreased as MC rose. Overall, pressure drop increased with moisture content, ranging from 218.7 ± 0.94 Pa to 342.7 ± 8.9 Pa for pine residues as moisture content increased from 7.1% to 39.4%, and from 120 ± 5.0 Pa to 268.67 ± 1.0 Pa for MSW. Validation of the revised Ergun equation using experimental data yielded the viscous and kinetic energy losses constants k_1 and k_2 of 270.53 and 1.13 for pine residues, and 318.72 and 3.67 for MSW, respectively. The modified correlation demonstrated improved predictive accuracy, reducing the relative mean deviation by up to 75%.

Title: Wind band literature by underrepresented composers

Primary Author: Edward Davis

Additional Authors:

Mentor: Nancy Barry

Department/Program: Department of Curriculum and Teaching

College: College of Education

Abstract: Much research has been conducted on wind band literature, specifically research that identifies what constitutes great literature and why those pieces are worthy to be studied by concert ensembles. Many lists have been compiled that name specific works of wind band repertoire that fit these criteria. One area that has only recently been considered are works by composers from underrepresented populations. These include works by minorities, women, and composers who identify as LGBTQIA+. Few works by these composers appear on these lists. The purpose of this exploratory qualitative research study is to identify works of wind band literature by composers from underrepresented populations that are important to the genre and therefore worthy to be studied and performed. Data was collected via a semi-structured interview with an expert on wind band literature. From this data several themes emerged, including historical perspective, repertoire selection, and diversity. Future studies are needed to compile a list of pieces of music by composers from these underrepresented populations. These lists are valuable to music education as there is a need to expand repertoire lists to include music by these composers. This study seeks to answer three research questions: What criteria determines pieces of wind band music that are worthy of study? What criteria defines which composers are considered underrepresented? What are pieces worthy of study written by underrepresented composers? This is an area of concern for music educators due to the limited research about music written and performed by marginalized populations. Students and ensembles need to know that there are people who look like them who are composing music for wind band at the highest level, on par with some of the great pieces that have been performed for years.

Title: Before and after analysis of rectangular rapid flashing beacon (RRFB) to improve pedestrian safety

Primary Author: Elaina Fife

Additional Authors:

Mentor: Huaguo Zhou

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Among the various devices used at pedestrian crossings, the Rectangular Rapid Flashing Beacon (RRFB) aims to enhance driver awareness and improve pedestrian safety. Across the United States, an increase in pedestrian fatalities at uncontrolled crosswalks has shown a need for improvements in safety solutions. This study analyzes the effects of RRFB at an uncontrolled pedestrian crossing by studying pedestrian and vehicle behavior before and after the device was installed on Auburn University's campus. The necessity and effectiveness of the device were analyzed for an uncontrolled multilane crossing with the specific characteristics of a college campus environment on West Glenn Avenue through video observation and data extraction. During the study, 300 events were collected before and after installation. Before installation, a high percentage of vehicles yielded to pedestrians, with the most common type being a soft yield. Only a small percentage of pedestrians were unobservant at the busy intersection during both observation periods. After the device was installed, the percentage of unyielding drivers decreased by 13%; however, the results were affected by a defect in the reflective flashing device. The total yield rate increased from 77% before installation to 90% after they were installed. These findings highlight the significant improvements in pedestrian safety that RRFB-equipped crosswalks provide through increased driver yielding rates at conflicted, high-traffic crosswalks.

Title: Biblical womanhood in Early America: Christian women and social justice

Primary Author: Eleanor Lombardi

Additional Authors:

Mentor: James Ryan

Department/Program: Communication and Journalism

College: College of Liberal Arts

Abstract: While early and modern American ideals of Christian womanhood emphasize submission and silence, the Bible tells a different story, one in which women play vital, active roles in leadership and church ministry. For centuries, patriarchal interpretations of biblical scripture have warped the way women are viewed as mothers, wives, employees, and members of society as a whole. The objective of this research was to demonstrate how notable women throughout the 19th, 20th, and 21st centuries have challenged society's prevailing norms and advanced the role of women. To do this, I analyzed the work of pioneering female authors. I also researched influential women who advanced the early church. I included Beth Allison Barr's analysis of scripture, which supported my findings (the Fall of Eve in the book of Genesis, Matthew 22:37-39, Matthew 26:6; Mark 14:3-9; Luke 7:37-50, Ephesians 5:21-22, Mary Magdalene, and ten women recognized by Paul such as Phoebe, Prisca, Mary, Junia, Tryphaena, Tryphosa, Persis, Julia, and Nereus's sister). I then compared my textual analysis of both historical writings and biblical passages, examining patterns of women's leadership and the shifts in interpretation across different eras. I also traced how narratives of submission were constructed and challenged over time. Nowadays, the patriarchal view of biblical womanhood goes by another name, complementarianism, a system born in white evangelicalism that uses the Bible to justify male authority and reject the idea of female leadership in the church. The persistence of complementarianism and its exclusion of women from leadership demonstrates a new type of submission for women, echoing a much older story, one still waiting for resolution.

Title: Fluoride vs Fluoride-Free Toothpaste: What Does the Evidence Say for Children and Adolescents?

Primary Author: Elizabeth Campbell-Work

Additional Authors:

Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Fluoride toothpaste is a cornerstone of dental caries prevention in children and adolescents, supported by strong evidence from both individual and community-level fluoride interventions, including water and salt fluoridation. However, increasing caregiver concerns regarding fluoride ingestion and fluorosis have led to growing interest in fluoride-free toothpaste alternatives. This review synthesizes current evidence comparing fluoride-containing and fluoride-free toothpastes with attention to caries prevention, enamel protection, and safety considerations in pediatric populations. The literature consistently demonstrates that fluoride toothpaste reduces caries incidence and is cost-effective when used within recommended dose ranges, with minimal fluorosis risk under proper supervision. Emerging evidence suggests that select fluoride-free formulations, particularly those containing hydroxyapatite or bioactive glass, may promote enamel remineralization and demonstrate comparable effects to low-dose fluoride toothpastes in specific clinical trials; however, results vary by formulation, study design, and outcome measured. Pediatric trials indicate that fluoride-substituted hydroxyapatite toothpastes can favorably modify caries-related risk factors such as plaque pH and bacterial composition, though direct evidence of superior caries prevention remains limited. In vitro studies further show that fluoride-containing toothpastes provide greater protection against erosive tooth wear compared with most fluoride-free formulations, despite some hydroxyapatite products offering partial benefit. Across studies, outcomes are strongly influenced by baseline caries risk, caregiver supervision, toothpaste amount, and adherence rather than toothpaste composition alone. Overall, fluoride toothpaste remains the most evidence-supported option for pediatric caries prevention, while select fluoride-free alternatives may be reasonable in specific, well-defined contexts when risk factors and supervision are carefully considered.

Title: The Influence of Aging on Electrical Connector Extraction Forces

Primary Author: Elizabeth Gainey

Additional Authors:

Mentor: George Flowers

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: This work examines the effects of aging on the extraction forces of different electrical connector plating types. Historically, solders and plating finishes for most electrical and electronic applications have been composed of tin-lead alloys, which have improved solderability and aging properties in comparison to many alternatives. However, the use of tin-lead alloys for commercial applications has largely ended due to the hazardous effects of lead on the environment. Accordingly, there is considerable interest in the mechanical behavior of alternative formulations to determine their characteristics, particularly as they age. One important metric for the performance of electrical connectors is the extraction forces between the mated elements of the connector, which determines the stability of the electrical contact and the resulting circuit. This research examines the extraction forces of sample connectors after accelerated aging for various time periods. Previous work has been conducted with a limited sample size on tin-plated electrical connectors, and the results have shown that longer aging times affect the forces needed to demate the selected connectors. This work extends the previous study by comparing the performance of tin-, silver-, and gold-plated connectors in order to evaluate the relative performance of the selected lead-free tin alloys to the more costly silver and gold formulations.

Title: Revisiting Orexin Signaling as a Therapeutic Target: Implications for Sleep and Mental Disorders

Primary Author: Elizabeth Helms

Additional Authors: Muralikrishnan Dhanasekaran;Suhrud Pathak;Keyi Liu;Dillon Hammell;Ford Copeland;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Orexin (hypocretin) receptors, orexin receptor type 1 (OX1R) and type 2 (OX2R), are G-protein-coupled receptors that play essential roles in arousal, sleep–wake regulation, motivation, feeding behavior, and metabolic processes. Although early research primarily focused on their involvement in sleep regulation, subsequent studies have demonstrated broader neurophysiological functions. Orexin receptor antagonists, initially developed as treatments for insomnia, have demonstrated favorable safety profiles and efficacy in improving sleep architecture compared with traditional sedative & hypnotics. Given the interaction between orexin signaling and dopaminergic and other neuromodulatory pathways, these ligands may offer therapeutic benefits for disorders involving both sleep disturbances and dopaminergic dysregulation. Emerging evidence suggests potential applications of orexin receptor antagonists in conditions such as sleep disorders and schizophrenia, where impairments in arousal, sleep, and dopamine signaling frequently coexist. This study examines recent findings on the use of orexin receptor antagonists beyond insomnia, with a particular focus on their therapeutic potential in restless legs syndrome and schizophrenia, highlighting their promise as mechanistically targeted and well-tolerated treatment options for complex neuropsychiatric disorders.

Title: Conjugation of the proteasome inhibitor bortezomib to the TROP2 antibody sacituzumab to directly target TNBC cells

Primary Author: Elizabeth Warford

Additional Authors: Alexei Kisselev; Rashad Karimov; Sara Zerangnasrabad;

Mentor: Alexei Kisselev

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Triple-negative breast cancer (TNBC) is an aggressive form of breast cancer with low survival rates after metastasis. Bortezomib (BTZ) and other proteasome inhibitors (PIs) have been shown to kill TNBC cells in vitro at similar rates to those observed in multiple myeloma (MM), a blood cancer for which PIs are FDA-approved treatments. However, TNBC is a solid tumor, making it difficult to target with PIs, as the body clears them out before they reach the tumor site. BTZ also has off-target effects, leading to cardiovascular toxicity and neurotoxicity. Identifying a way to directly target the TNBC cells provides a solution to reduce the toxic effects of BTZ while also ensuring the cancer receives the drug prior to systemic clearance. One way to target TNBC is by synthesizing an antibody drug conjugate (ADC) attached to BTZ. The TROP2 antigen is overexpressed in TNBC subtypes, making it an ideal target for ADC therapy. The TROP2 antibody, Sacituzumab, has previously been used in FDA-approved ADCs to target TNBC. Our goal is to conjugate BTZ to the TROP2 antibody, Sacituzumab, leading to direct targeting of BTZ to TNBC cells. This requires a novel multistep synthesis to create a linker with which the drug is attached to the antibody, so that it can be cleaved within the cell to release the drug. During the synthesis phase, many steps will be taken to ensure the linker is following the desired formation, including using analytical devices like NMR. After the linker is successfully made, it will be added to the TROP2 antibody using previously optimized conjugation conditions. After successful conjugation, the ADC will be tested in vitro alongside free BTZ to see if the ADC gets cleaved and releases BTZ in biological conditions and if it kills TNBC at similar rates to free BTZ, ensuring its structure and function were not affected.

Title: Mitigating Burnout Through Design A Case Study of a Domestic Violence Center

Primary Author: Ellie Rea

Additional Authors: Peter Weber;Anna Ruth Gatlin;

Mentor: Anna Ruth Gatlin

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Burnout is widespread among the nonprofit sector's professionals. The types of work and social issues that nonprofit professionals often confront can lead to feelings of helplessness and frustration. As a result, research shows that 95% of nonprofit leaders expressed feeling burned out, causing a decrease in the nonprofit professional's wellbeing and ability to successfully fulfill the organization's mission. However, scholarship in interior design shows that the built environment can significantly impact occupants' wellbeing both positively and negatively through interior design elements such as exposure to nature, effective space planning, and appropriate light sources. While the interior design literature discusses the relationship between the occupant and built environment, research on how interior design can influence a nonprofit professional's ability to fulfill the organization's mission is limited. Drawing on a domestic violence center as a case study, this study examines how (if at all) the built environment impacts the burnout of nonprofit professionals and thus influence a nonprofit organization's ability to carry out its mission. A semi-structured interview and walkthrough of a nonprofit's space is used to gather data. Findings from the study will identify interior design factors that either exacerbate or alleviate a nonprofit professional's burnout. The study will also propose interior design guidelines that may attenuate future burnout among nonprofit professionals when applied to their built environment.

Title: Physiological characterization of Different Salmonella Serotypes in Low-Water Food Matrices.

Primary Author: Elva Hernandez Guatemala

Additional Authors: Shabarinath Srikumar;Stephen White;Erin Olander;Greeshma Bharathan;Sidra Nazeer;

Mentor: Shabarinath Srikumar

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Foods with low water activity (desiccated food/low aW foods) are considered safe for consumption. The low content of available water supposedly inhibits bacterial growth. However, organisms such as Salmonella can survive desiccated environments presented by low aW foods. Salmonella is therefore associated with numerous foodborne outbreaks in desiccated foods, including milk powder, infant formula, egg yolk powder, etc. These desiccated foodborne outbreaks emphasize the need for a detailed investigation of serotype-specific growth responses, particularly focusing on uncommon serotypes, to understand their persistence in low-water food environments. This study aimed to evaluate the survival of eight Salmonella serotypes, including *S. Aberdeen*, *S. Agona*, *S. Anatum*, *S. Diarizonae*, *S. Oranienburg*, *S. Kentucky*, *S. Montevideo*, and *S. Typhimurium*, during desiccation in TSB, milk powder, and egg yolk powder over 48 hours. The previously characterized desiccation-tolerant strain *S. Typhimurium* ST4/74 was included as a reference. Each serotype was inoculated independently in triplicate into each matrix, and viable counts were determined at different time points (0, 1, 2, 3, 4, 5, 24, and 48 hours). Differences between 0 h and 48 h were analyzed using Student's t-test ($p < 0.05$). Even though Salmonella survived desiccation stress until 48h, there was a significant drop in the viability of Salmonella across matrices during desiccation stress. Averaging all serotypes, only about 0.008% and 0.009% of cells retained viability after 48 hours during desiccation. However, egg yolk powder supported desiccation survival more, since on average, about 0.02% of the cells retained viability after 48 hours. *S. enterica* subsp. *Diarizonae* and *S. Anatum* had the lowest survival in egg yolk powder at 48 hours (~0.009%), while all other tested serotypes showed better viability (~0.02%). Of this, *S. Aberdeen* and *S. Typhimurium* had the highest viability (~0.04%) in egg powder at 48 hours. These findings confirm that desiccation tolerance in Salmonella enterica is serotype and matrix dependent. The variation among serotypes emphasizes physiological differences that may influence persistence and potential risk in dry-food production environments. Understanding these survival dynamics contributes to more accurate risk assessment and can inform control strategies aimed at reducing Salmonella contamination in low-moisture food systems, thereby improving food safety in powder-based products.

Title: Postharvest performance and sensory profile of 'Favorita' cherry tomato grown in saline split-root hydroponic systems

Primary Author: Elvia Lopez Cordon

Additional Authors: Alvaro Sanz Saez de Jauregui;Sungeun Cho;Daniel Wells;

Mentor: Marlee Trandel

Department/Program: Horticulture

College: College of Agriculture

Abstract: Split-root hydroponic systems enable precise evaluation of how root-zone salinity affects postharvest and sensory quality in cherry tomato. 'Favorita' plants were grown under 0, 4.5, and 9 ppt NaCl to quantify salinity-driven changes in fruit quality, storage behavior, and flavor. Fruits were harvested weekly and stored 10 days at 24 °C and 56% RH. Measurements at 0, 3, 5, 7, and 10 days included %WL, diameter, color (a^* , b^* , c^*), firmness (N), SSC, TA, and pH. Fruit diameter peaked mid-harvest (30.4 mm) relative to early (25.4 mm) and late (28.3 mm). Weight loss increased during storage, highest under moderate (17.0%) and high (15.7%) salinity. High salinity accelerated softening by 0.5 N, reduced fruit size (27.7 mm), increased redness (13.4), and decreased chroma (24.7). Moderate salinity produced the greatest SSC (9.3–10.0 °Brix), while TA peaked in control fruit early in storage (0.47–2.94). Salinity × harvest-week interactions showed SSC declining from 8.57 to 7.82 °Brix and TA from 1.75 to 1.56, slightly increasing SSC/TA (5.55–5.91). Later harvests exhibited improved quality. A trained sensory panel ($n=12$) evaluated fruit from a single harvest. SSC and TA were highest under medium (7.5 Brix, 0.8%) and high (7.6 Brix, 0.9%) salinity compared with control (5.6 Brix, 0.6%). SSC/TA peaked at medium salinity (11.8) and was lowest under high (8.6). Flavor intensity increased under medium (6.79) and high (6.96) salinity relative to control (5.79). Sweetness was greatest under high salinity (3.50), while sourness remained stable (4.13–4.75). Cluster analysis revealed clear salinity-driven sensory patterns. Overall, moderate salinity enhanced flavor through improved sweetness–acidity balance, while high salinity increased sweetness perception but reduced SSC/TA and fruit size.

Title: Echoes of design: the relationship between architecture, acoustics, and human experience

Primary Author: Emily Griffin

Additional Authors:

Mentor: Christian Dagg

Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: Sound plays a significant role in shaping human experience within urban environments through the ways architecture and landscape reflect, absorb, channel, and diffuse acoustic energy. This study investigates how measured acoustic conditions in urban areas relate to human perception within established, designed landscapes and built urban corridors. Despite growing awareness of sensory design, limited research examines how existing and historical urban environments can be systematically reinterpreted, evaluated, and improved through acoustic analysis. To address this gap, the project examines downtown Auburn's alleyways. Methods include on-site decibel measurements, public perception surveys, spatial documentation, and digital acoustic modeling to analyze sound reflections, spatial variation, and shifting acoustic behavior within frequently used pedestrian areas. Initial findings indicate that variations in façade articulation, surface materiality, spatial proportions, urban context, and fluctuations in overall city activity cause these narrow walkways to accumulate elevated and uneven sound levels. In several alleyways, measured sound levels exceeded approximately 70 dB during peak activity periods, resulting in stressful transitions from the main street rather than inviting pedestrian passageways. These results highlight the importance of integrating acoustic evaluation with spatial analysis to inform improvements in urban environments. More broadly, the research suggests that treating sound as a foundational design parameter, particularly within southeastern cities, can support additive, non-destructive, and repeatable interventions that enhance acoustic comfort, emotional resonance, and immersive spatial experiences in downtown public spaces.

Title: Measuring Parent Reflective Functioning: Dimensions, Methods, and Implications

Primary Author: Emily Hanson

Additional Authors:

Mentor: Mallory Lucier-Greer

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Parent reflective functioning refers to a parent's ability to envision and reflect on their child's mental states, such as their thoughts, desires, beliefs, and intentions, as well as their own (Slade & Sleet, 2024; Luyten et al., 2017). When parents are not able to see their child as someone with psychological agency, they may misinterpret their child's actions and respond in maladaptive ways, such as with distress or violence. As such, parent reflective functioning has implications for parent-child attachment, child abuse, and emotion regulation. Measurement of parent reflective functioning originated as a unidimensional construct and has since evolved into a multidimensional assessment encompassing three dimensions, each conceptualized along a continuum: pre-mentalizing (i.e., ability to enter into the subjective world of a child), certainty about mental states (i.e., degree of certainty of child's mental state ranging from overcertain to lack of certainty), and interest and curiosity (i.e., degree of interest in child's mental state ranging from absence to intrusive). In addition, parent reflective functioning has been captured through a variety of methodologies (e.g., semi-structured interview, self-report questionnaire, task-based measures). This research presentation will provide a synthesis of 6 measurement approaches for parent reflective functioning. Then, recommendations for the field will be provided in terms of advancing healthy parent-child attachment as well as identifying parents who may be at-risk of perpetrating child abuse.

Title: Neural markers of error recognition predict future cannabis-related motivation in people with Cannabis Use Disorder

Primary Author: Emily Lloyd

Additional Authors: Brandon Schermitzler;

Mentor: Samantha Fede

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Error recognition has been linked to problem awareness and motivation to change, processes that are particularly relevant in the study of substance use disorders. Neural indicators of error recognition, such as the error-related negativity (ERN), are observable using electroencephalography (EEG) and appear in the data as a negative deflection in EEG signal approximately 50-100 milliseconds after error commission. The present study examined whether neural markers of error recognition, like the ERN, could be used to measure problem awareness and motivation to change cannabis use habits in individuals with Cannabis Use Disorder (CUD). Participants (N = 44) ages 18-50 with a diagnosis of moderate or severe CUD were recruited to complete a Flanker task while EEG data were recorded. The Flanker task, designed to measure inhibitory control, presented participants with a row of five arrows and required them to indicate the direction of the third, center arrow. In the same visit, participants completed self-report measures of cannabis-related motivation to change and problem awareness. Participants then repeated both self-report measures once per month for five consecutive months. We hypothesized that ERN amplitude following an incorrect response on the Flanker task would predict participants' problem awareness and motivation to change. In a linear mixed-effects model, the main effects of Time and ERN failed to reach significance. However, a significant interaction between Time and ERN amplitude was observed, $F[5, 172] = 2.65$, $p = .024$, such that blunted ERN amplitudes were correlated with lower cannabis-related motivation to change. Another linear mixed-effects model was used to examine the main effects and interaction of Time and ERN on problem awareness, all of which failed to reach significance. These findings suggest that early neural markers of error recognition may be associated with future cannabis-related motivation to change and error recognition in individuals with CUD and highlight the importance of considering multiple motivational constructs when examining neurocognitive predictors of behavior change.

Title: Evaluation of Different Product Metering and Spreading Systems on Commercially Available Drones for Application of Cover Crop Seed

Primary Author: Emily Ward

Additional Authors: Jacob Sizemore;

Mentor: Simer Virk

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: In recent years, the use of drones for pesticide applications in agriculture has increased substantially across the United States. Dry product applications are now being rapidly adopted, as these systems allow users to quickly interchange liquid tanks with dry application tanks/hoppers. Currently, there are several types of product metering and spreading systems available on commercially available drones; however, there is limited information on their application performance in terms of the actual applied rate and distribution uniformity of product within the swath. The main goal of this study was to evaluate the performance of three commercially available drones for applying cover crop seed. Cereal rye was selected as the cover crop because of its extensive use. All data was collected using the DJI AGRAS T50, Hylío HYL-150, and XAG P150 drones. Their application performance was assessed by first examining the single-pass spread patterns across the swath under varying operational parameters including application rate, flight height and spread swath. The target application rates of 22.4, 44.8, and 67.3 kg ha⁻¹ were used across all drone platforms. The application heights of 3.8 for the DJI T50 and 4.6 m for the HYL- 150 & XAG P150 were used during the tests while the maximum flight speed of 10.0, 13.5 and 18.0 m s⁻¹ was used for the DJI T50, Hylío HYL-150 and XAG P150, respectively. The second experiment focused on investigating the distribution uniformity of (progressive) overlap patterns at varying swath widths. All tests were conducted using a target application rate of 44.8 kg ha⁻¹, while the evaluating the distribution uniformity at spread swaths of 4.9, 6.0 and 7.3 m across all of the drones. The field testing consisted of standard pan testing as per ASABE standard S386.2, where collection pans (0.5 m x 0.5 m) were placed at 0.6 m intervals across the swath. The single-pass patterns consisted of a single pass of the drone over the pans, whereas the overlap patterns involved three adjacent passes in a progressive application pattern. After each pass, the material collected from the pans were placed into pre-labelled sample bags for subsequent weighing and analysis. The data analysis is currently being conducted and will include plotting the single-pass and overlap patterns along with determining the mean applied rate, distribution uniformity (coefficient of variation, CV), and pattern skewness within the swath. The results of this study will advance the operational knowledge of dry material applications with the drones, enabling effective and efficient use of these systems.

Title: Preserving Identity in Post-Industrial Appalachia: Adaptive Reuse Strategies for Thurmond, West Virginia

Primary Author: Emma Carpenter

Additional Authors:

Mentor: Anna Ruth Gatlin

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: With new supervision from the National Park Service, many historic structures in Thurmond, West Virginia are facing demolition, dismantling the architectural and historical fabric of the town. This research investigates a collection of those historic structures in Thurmond, a former coal town located within the New River Gorge National Park. Once a thriving railroad hub with a strong cultural and architectural identity, Thurmond contains a network of historic buildings that have remained largely abandoned since the decline of the coal industry in the mid-twentieth century. In recent years, increasing pressure from the National Park Service to remove several of its deteriorating structures has placed the town's historic fabric at risk, prompting local residents, preservation advocates, and state agencies to seek viable strategies for long-term preservation. This action would undermine West Virginia's cultural identity and negatively affect local residents, historians, and tourists. Using precedent studies that integrate archival research, site analysis, and adaptive reuse planning strategies, this study examines revitalization as an alternative to demolition. Thurmond's existing Amtrak rail access, combined with its proximity to Fayetteville and Beckley, presents opportunities to expand heritage tourism, strengthen regional connectivity, and support economic development while reducing economic leakage. Ultimately, this study contributes to broader discussions on preservation advocacy, rural revitalization, and preventative planning strategies for historically significant communities situated within National Park boundaries.

Title: Exploring new immunotherapy avenues to target osteosarcoma

Primary Author: Emma Logsdon

Additional Authors: Sumbul Khan;

Mentor: Payal Agarwal

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Osteosarcoma (OS) is a malignant bone tumor accounting for approximately 3-5% of pediatric cancer cases and is the third most common bone tumor in adults in the United States. OS is highly metastatic and frequently exhibits multidrug resistance and a poor long-term response to standard therapies, highlighting the need for new treatments. Immunotherapy has shown strong potential in targeting OS and other solid tumors. This study evaluated the oncolytic activity of conditionally replicative adenovirus (CAV2-AU-M3) armed with the immune checkpoint inhibitor, anti-PD1 antibody. It was hypothesized that CAV2-AU-M3 would replicate and lyse the OS cells and produce a secretory anti-PD1 HcAb. To test this, the canine OS cell line MCKOS was cultured and plated as 2D monolayers in an 8-chambered glass slide, then infected with CAV2-AU-M3 with different multiplicities of infection (MOI), viz, 0, 10, 100, and 500 MOI. After 48 hours following infection, the cells were fixed and stained with the rabbit anti-camelid VHH antibody and the mouse anti-CAV2 antibody. Fluorescence microscopy was used to evaluate the expression of anti-PD1 HcAb and CAV2 infection in the tumor cells using the Keyence Imaging system. Using immunofluorescence (IF) analysis, anti-PD1 HcAb and CAV2 presence were observed with a stronger signal at 500 MOI, a moderate signal at 100 MOI, and a faint signal at 10 MOI. These results indicate that CAV-AU-M3 successfully infects the MCKOS osteosarcoma cell line cultured in 2D monolayers and expresses anti-PD1 HcAb. These results support CAV-AU-M3 as a next-generation oncolytic virus with the ability to infect OS cells and express anti-PD1 HcAb.

Title: Why Placement Matters: Spatial Alignment of RRFB Push Buttons and Its Impact on Pedestrian and Driver Behavior

Primary Author: Ernest Nsong Asiedu

Additional Authors: David Pridgeon;Elaina Fife;Md Roknuzzaman;

Mentor: Huaguo Zhou

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: The study explores the significance of spatial placement and alignment of Rectangular Rapid Flashing Beacons (RRFB) at uncontrolled midblock crossings on pedestrian activation and driver yielding rates. Using field observation data from 12 crosswalks in Auburn, Alabama, a total of 2,038 pedestrian-vehicles interactions were extracted from video data. Logistic regression models were developed using geometric, pedestrian, vehicle and spatial design features for each observation. The comparison of the regression models revealed that spatial placement factors, especially proximity of the push button within 3 feet of the roadway and its angle facing traffic, significantly impact behavior. Push buttons positioned more than 3 feet from the edge of travel lane reduced the odds of pedestrian activation by 87%, while buttons oriented towards traffic significantly increased pedestrian activation rates. Similarly, driver yielding rate is 7.4 times more likely when the button faces outgoing traffic. The findings highlight how spatial placement and alignment of RRFB push buttons directly influence pedestrian activation and driver yielding rates, providing practical, evidence-based recommendations to optimize placement and orientation in accordance with Manual on Uniform Traffic Control Device (MUTCD) guidelines on safe and effective installations.

Title: Investigating hurricane impacts on ecosystems in the Southeast US

Primary Author: Evan Farry

Additional Authors:

Mentor: Sanjiv Kumar

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The Southeastern United States boasts a variety of unique ecosystems that provide many services to society but also face many challenges. Considering weather events, this region faces some of the most extreme weather in the world, especially with hurricanes and severe storms. While these ecosystems are resilient and can be both helped and harmed by weather events, knowing exactly how they respond, and how they are effected by different intensities of events, is imperative for their future conservation and management. The rise of AmeriFlux towers for ecological research and their abundance in the Southeast provides an opportunity to analyze this relationship further. This research will utilize this AmeriFlux data, along with NOAA and NASA environmental data, and aim to lay the framework for understanding and predicting how intensities of storm events impact Southeastern ecosystems. Specific tower sites within the study area were selected based off data availability and known hurricane hits within its operation. In-depth time series models for variables of interest such as wind speed and precipitation were created and compared with Gross Primary Productivity (GPP) response and climate indices centered on hurricane events to identify any potential trends or relationship. This information will be used to craft a machine-learning model framework for the effective prediction of ecosystem damage and response to different storm intensities. So far, the analysis has shown that there are significant short-term fluxes in GPP and these indices as a result of hurricane events, but an absence of long-term effects, which could be explained by a lack of strong-intensity storm hits on the flux towers in their operation timeframes. Further planned analysis of these variables in other non-tropical storm occurrences will lead to a clearer understanding of how overall intensity impacts ecosystem health and recovery.

Title: Evaluation of cross-sectional area estimation and empirical predictive yield load modeling in 3D-printed PLA dogbone samples with non-solid infill

Primary Author: Evan Pollard

Additional Authors: Michael Zabala;Jaxie Brokamp;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: The mechanical performance of 3D-printed parts is often difficult to predict due to the anisotropic nature and variability introduced during the printing process. Accurate calculation of critical strength properties, such as yield strength, ultimate tensile strength, and elastic modulus, depends on knowing the cross-sectional area of each sample. However, for non-solid infill samples, this area is not directly measurable but can be estimated using slicer-defined parameters such as layer height, line width, and infill density. The objective of this research is to determine and analyze the mechanical properties of 3D-printed PLA dogbone samples with non-solid infills under tensile loading. By conducting tensile tests for samples with rectangular and circular cross-sections of varying dimensions, the study evaluates whether the estimated cross-sectional areas produce mechanical property values consistent with those of solid infill samples reported in existing literature. Results showed that the maximum mean error between calculated and estimated area was $-4.396 \pm 5.944 \text{ mm}^2$ for rectangular samples and $6.227 \pm 27.916 \text{ mm}^2$ for circular samples, suggesting that area estimation is reasonably accurate with some variability depending on geometry. In addition, the research uses the yield load empirical data to develop a predictive algorithm capable of estimating the yield load of a 3D-printed dogbone sample based solely on its cross-sectional geometry. The accuracy of this model is validated by comparing its predictions to experimentally measured yield loads of samples with known dimensions. Results showed that all predictions fell below a 2% difference between the predicted and experimental values for rectangular samples and below an 11% difference for circular samples. Together, these efforts support the broader goal of enabling reliable strength prediction for 3D-printed parts without the need for destructive testing.

Title: Design and Development of a Robotic Overhead Camera System for Automated Greenhouse Monitoring

Primary Author: Faraz Ahmad

Additional Authors:

Mentor: Tanzeel Rehman

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Greenhouse has gained increasing attention as a sustainable approach to optimize horticultural production and enhance resource efficiency. It plays a critical role in advanced plant phenotyping in controlled-environment agriculture, enabling breeding programs to develop more resilient cultivars by facilitating precise monitoring of growth patterns and physiological traits across diverse environmental conditions. However, existing phenotyping methods often rely on manual data collection that can be time-consuming, labor-intensive, and challenging to maintain continuity. To address this gap, this study aims to develop a fully automated, linear robotics overhead camera system capable of continuously collecting plant and environmental data with minimal human intervention, thus significantly reducing labor requirements while yielding a enriched dataset for optimal crop management and phenotyping. Central to this initiative will be the development of a 2-degree-of-freedom overhead gantry camera system specifically designed for greenhouse environments. The system will incorporate a Jetson platform as its main computing unit and will integrate a programmable servo-based motion controller to facilitate precise, repeatable movements across the canopy. A lightweight yet robust aluminum gantry frame, combined with a high-precision electrical subsystem, will support key sensors, including a Zed camera for RGB and depth imaging and a hyperspectral camera for capturing spatial spectral signatures. The system will enable controlled data collection by programming specific imaging schedules and paths, ensuring consistent and accurate data acquisition. Environmental sensors, such as temperature and humidity monitors, will be included to track microclimate variations. Data will be transferred via Ethernet or Wi-Fi for high-bandwidth image transmission, while LoRa WAN will handle continuous remote transmission of environmental parameters. By automating data acquisition and extending capabilities to various lighting and temperature conditions, the system will enhance greenhouse research and commercial applications through improved data quality, increased spatiotemporal resolution, and optimized decision-making processes.

Title: A framework for tree-level aboveground biomass estimation in single- and mixed-species forest stands in the southeastern U.S. using UAV-based multispectral imagery and machine learning

Primary Author: Favour Onyido

Additional Authors: John Kush;Richard Cristan;Adam Maggard;

Mentor: Lana Narine

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Accurate tree-level carbon estimation is crucial for precise forest carbon accounting and evaluating climate change mitigation efforts. Remote sensing (RS) technologies, such as Unmanned Aerial Vehicles (UAVs), enable non-destructive, fine-scale approaches to estimating aboveground biomass (AGB) at the tree level. Although previous work has explored UAV-based AGB estimation at the individual tree level, research remains limited on species-specific tree-level modelling, especially in complex mixed-species forests. This study serves to establish a tree-level UAV-based framework by integrating high-resolution UAV imagery with species-specific AGB allometry in heterogeneous stands. Specific objectives were to: (1) determine optimal processing and modeling approaches for species-specific AGB estimation using features from UAV multispectral data, and (2) evaluate and compare machine learning (ML; random forests and support vector machines) and deep learning (DL; deep convolutional neural networks) techniques for AGB estimation. Study plots were established in single- and mixed-species forest stands in Auburn, Alabama. A low-cost, consumer-grade UAV (DJI Mavic 3M) was used to acquire multispectral imagery (Red, Green, Blue, RedEdge, NIR), with the acquisition temporally coinciding with the ground-based field inventory. Using orthomosaics and structure-from-motion point clouds generated from the imagery, we extracted spectral, structural, and textural metrics for species classification and AGB modeling. For individual tree detection, deep learning-based techniques outperformed traditional local maximum filtering with both fixed and variable window sizes across both stand types. The best-performing models achieved a weighted overall species classification accuracy of 79% (Cohen's kappa = 0.7) and AGB estimation fit of 0.67 and 0.63 (R^2) for the single- and mixed-species stands, respectively. Collectively, these results demonstrate the potential of applying low-cost UAV-based approaches for fine-scale forest AGB estimation. This study is expected to contribute to the advancement of UAV-based forest AGB estimation and support monitoring efforts.

Title: Is It Worth It? How Value-Focused Influencers (VFIs) Shape Consumer Perceptions

Primary Author: FNU Al-Amin

Additional Authors: Angie Lee;

Mentor: Angie Lee

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Social media influencers play an increasingly important role in shaping consumer perceptions and purchase decisions, yet growing skepticism toward sponsored content has challenged traditional influencer marketing. In response to this shift, a new category of influencers has emerged who critically evaluate products based on price, quality, and overall value. This conceptual paper introduces and conceptualizes these influencers as Value-Focused Influencers (VFIs) and examines how consumers respond to their content compared to traditional social media influencers (SMIs) and de-influencers. The study proposes to explore how consumers interpret VFIs' critiques and how these interpretations differ across influencer types. Furthermore, grounded in the Persuasion Knowledge Model (PKM), which explains how consumers develop knowledge about persuasive intentions and use it to interpret and cope with marketing attempts over time (Friestad & Wright, 1994), the study further investigates whether consumer reactions change over time as persuasion knowledge develops may also be investigated. Methodologically, the study suggests collecting user comments from social media posts, analyzing them through sentiment analysis and semantic network analysis, and conducting longitudinal analysis to capture temporal shifts in responses. The study offers theoretical contributions by extending influencer marketing literature through the introduction of VFIs and by applying PKM to emerging influencer roles. Practically, the findings may inform VFIs and brands about consumer expectations for transparency, authenticity, and value-based communication in digital marketplaces.

Title: Evaluation of new rabbiteye blueberry (*Vaccinium virgatum*) cultivars for productivity and fruit quality

Primary Author: FNU Jagjit Singh

Additional Authors: Edgar Vinson; Marlee Trandel;

Mentor: Elina Coneva

Department/Program: Horticulture

College: College of Agriculture

Abstract: Blueberry acreage in Alabama has increased by 38% from 2017 to 2022. New rabbiteye blueberry cultivars with improved fruit quality attributes have been released, but limited information is available on their performance under Alabama conditions. This study aimed to evaluate the horticultural performance of recently released rabbiteye blueberry cultivars Alapaha, Krewer, Ochlockonee, Pink Lemonade, Titan, and Vernon and compare their productivity and fruit quality attributes to the well-established cultivars Climax, Powderblue, Premier, and Tifblue. An experimental plot was established at the Chilton Research and Extension Center, Clanton, AL in 2019. A randomized complete block design with four blocks was used, and data were collected during 2024–2025. Environmental conditions differed between seasons, with 67% higher rainfall during May to July in 2025 compared to the same period in 2024. Results indicated that cultivar significantly affected total yield per plant and all fruit quality traits, while year influenced total yield per plant, individual berry weight, fruit firmness, total soluble solids (TSS), titratable acidity (TA), and TSS: TA ratio. Total yield per plant was higher in 2025 across cultivars, with 'Vernon' producing the highest yield (14.2 kg plant⁻¹), followed by 'Ochlockonee' (11.1 kg plant⁻¹), whereas cultivar Pink Lemonade consistently had the lowest yield. 'Titan' berries were the largest, with mean berry weights of 3.3 and 3.4 g, followed by 'Krewer' with mean berry weights of 2.7 and 2.9 g in 2024 and 2025, respectively. Cultivar Titan produced the firmest berries in both years, whereas 'Pink Lemonade' fruit was the softest. Standard cultivar Climax had the highest TSS in both years, although TSS and TSS: TA declined in 2025 while TA slightly increased, indicating a seasonal shift in sweetness and flavor balance. Overall, these results provide cultivar-specific guidance for selecting rabbiteye blueberry cultivars adapted to Alabama conditions.

Title: Intentional and Unintentional Sustainable Consumption Behaviors: The Role of Basic Human Needs and Regulatory Focus

Primary Author: Fnu Parul

Additional Authors: Young A Lee;

Mentor: Young A Lee

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Prior research on sustainable consumption has largely emphasized intentional behaviors driven by individual factors such as values, attitudes, and environmental awareness. However, sustainable outcomes may also arise unintentionally through motives such as thrift, habit, convenience, and resource saving. Despite their relevance, intentional and unintentional sustainable consumption behaviors are rarely examined together. Moreover, scholars urge moving beyond an individual-level focus to account for the broader systems, including economic contexts, that shape consumption practices. Drawing on Maslow's needs theory, Kaufman's sailboat metaphor, and regulatory focus (RF) theory, this study develops an integrative framework that positions security and growth needs as central drivers of sustainable consumption. The framework further incorporates RF (prevention vs. promotion) as a moderator, influencing how these needs are translated into both intentional and unintentional sustainable consumption behaviors. This study argues that in emerging economies facing economic uncertainty, the salient security needs tend to drive unintentional sustainable consumption. In contrast, in abundant self-expressive consumer economies, growth needs are more likely to drive intentional sustainable consumption. RF is proposed to condition these relationships, with a prevention focus strengthening the influence of security needs on unintentional sustainable consumption, whereas a promotion focus strengthens the influence of growth needs on intentional sustainable consumption. By jointly examining basic human needs, RF, and economic context, the proposed framework advances sustainable consumption research beyond attitudinal explanations and highlights the role of both conscious and subconscious motivations. It further offers important theoretical contributions and practical insights for developing more inclusive and context-driven sustainability strategies across diverse economic systems.

Title: Morphological variation among invasive island populations of brown anoles (*Anolis sagrei*)

Primary Author: Gavin Kerr

Additional Authors: Daniel Warner;Anthony Gilbert;Sydney Wayne;Chris Norris;

Mentor: Daniel Warner

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Islands that are severely impacted by gulf storms or hurricanes are frequently re-colonized by species that were present prior to extirpation. Many species that colonize these islands are faced with new ecological conditions that either vary between islands, or that differ substantially from the mainland. Such environmental heterogeneity can act as a driver of trait values through both natural selection and/ or phenotypic plasticity. In 2013 and 2022, *Anolis sagrei* were collected from two populations on small spoil islands in the Tomoka River, Florida. These islands varied extremely with respect to temperature, moisture, and canopy cover, and are subjected to repeated disturbances. We selected males and females from each island population from both time points. We measured external morphological traits and dissected individuals to measure the morphology of various organs. We then compared these measurements within and between the islands and time points to quantify spatial and temporal variation in morphology. We hypothesized that the environmental drivers of phenotype are consistent across time, leading to consistent trait value within islands regardless of year. By testing for repeatable environment-phenotype association, our results will demonstrate how strong and persistent ecological conditions might shape morphology and provide insight into the processes that shape phenotypic variation in populations.

Title: Investigating viral and bacterial coinfection in cultured Largemouth Bass

Primary Author: Gavin Southern

Additional Authors: Brent Vuglar;

Mentor: Timothy Bruce

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Largemouth bass (LMB) are an important freshwater fish in industries such as sports fishing, conservation, and more recently, aquaculture production. As high-density LMB production is relatively new, many challenges remain, including early feed training, optimized production conditions, and disease. Disease prevalence may be a barrier to entry for aquaculturists looking to raise LMB, and enhancing survivability during the critical early rearing period will increase market potential for this species. Two significant diseases in LMB culture are columnaris (caused by *Flavobacterium columnare*) disease and largemouth bass virus (LMBv; genus *Ranavirus*). There is currently no novel treatment for LMBv and producers may use antibiotics to treat columnaris disease. As such, understanding both infection dynamics and treatment options is important for increasing LMB production yields. To address this problem, a study was designed to discern optimal challenge doses of LMBv and *F. columnare* and assess in vivo virulence when LMB are coinfecting with both pathogens. Two pilot studies preceded the primary coinfection trial to ensure an accurate lethal dose of ~50%. For the main coinfection challenge, juvenile LMB were stocked into 24 tanks (25 fish per tank). For inoculum preparation, *F. columnare* (strain ARS-LMB-23-5) was cultured using modified Shieh broth (MSB) and fathead minnow cells (FHMs) used to propagate LMBv. An appropriate dose determined from the pilot challenges with *F. columnare* ($\sim 5 \times 10^6$ CFU/mL) or LMBv was administered as a single dose or as a combined coinfection. Following the challenge, the fish were monitored for 14 days, and mortalities necropsied to confirm pathogen presence. The mortality data was analyzed using a one-way ANOVA and also Kaplan-Meier survival analysis. The study results will help expand the discovery of novel treatment plans for both columnaris and LMBv by understanding virulence and pathogenic mechanisms in LMB.

Title: Biological control of Root-knot nematode and growth promotion in cotton through plant growth-promoting rhizobacteria

Primary Author: Gayatri Bhandari

Additional Authors: Bisho Lawaju;

Mentor: Kathy Lawrence

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Cotton (*Gossypium hirsutum*) production in the Southeastern United States is severely constrained by *Meloidogyne incognita* (Root-Knot Nematode, RKN), which causes significant root damage and yield loss. To address these issues, a study was conducted to evaluate the effectiveness of plant growth-promoting rhizobacteria (PGPR) strains in reducing nematode populations and improving cotton performance. A library of 235 PGPR strains was screened in-vitro for nematocidal activity, from which 37 top-performing strains were advanced to greenhouse and seven to field evaluations. Greenhouse experiments included water, the chemical fluopyram, and biological majestene as controls. Trials followed a RCBD design with five replications and were conducted twice. Field studies were conducted using the same experimental design and same control treatments. Nematode density (nematode eggs per gram of root) was major response variable in greenhouse while, height, fresh biomass, and nematode density, and yield were measured in field studies. In greenhouse, DT-155 (*Pseudomonas turukhanskensis*) significantly reduced nematode density (6348 eggs/g root), comparable to treated controls. In field studies, stand count ($P = 0.098$), plant height ($P = 0.98$) and plant biomass ($P = 0.46$) were consistent across treatments. DT-129 (*Arthrobacter nitrophenolicus*) produced the numerically tallest plant (25.75cm), greatest biomass (8.84 gram). DT-87 (*Bacillus amyloliquefaciens*), DT-204 (*Sphingomonas kyeonggiensis*), and DT-105 (*B. velezensis*) also achieved significantly lower densities- 2,709, 2,951, and 3,536 eggs/g root, respectively ($P \leq 0.005$). Yield data revealed that DT-105 achieved the highest lint yield. This research lays the foundation for identifying top-performing PGPR strains in RKN-infested fields to assess their practical application in sustainable nematode management and cotton growth promotion.

Title: Early Gonadal Tissue Development in Offspring of Mouse Dams Treated with Anti-Luteinizing Hormone Antibodies

Primary Author: Gerardo Saavedra-Castilla

Additional Authors: Aime Johnson;Douglas Martin;Gabrielle Schultz;Arthur Zimmerman;

Mentor: Douglas Martin

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The overpopulation of stray cats and dogs is a significant issue in the United States as shelters are often overcrowded, leading to approximately 670,000 animals being euthanized annually. The primary method of companion animal sterilization is spay/neuter; however, there are long term-implications of these procedures such as increased risk of developing Feline Cognitive Dysfunction (FCD) or Canine Cognitive Dysfunction (CCD), obesity, hypothyroidism, urinary incontinence, and other physiological conditions. Therefore, there is a critical need for alternatives to traditional spay/neuter. Removal of the gonadal organs leads to dysfunction of the hypothalamic-pituitary-gonadal (HPG) axis by disrupting hormonal feedback mechanisms. Therefore, this study aimed to identify an alternative method of traditional spay and neuter by regulating levels of luteinizing hormone (LH), an important pituitary hormone, through antibody gene therapy via adeno-associated virus (AAV) vectors. AAV-mediated anti-LH antibody treatment lowered LH serum levels and altered estrous cyclicity. Although variable, litter size was similar between treated and control dams, and there appeared to be no effect of treatment on reproductive ability. However, brain anti-LH antibody titers were present in several pups from both 1A4H3- and 6C10D8-treated dams. This early exposure to anti-LH antibodies could hinder the normal development of the reproductive organs, as the pre-weaning period has been shown to be necessary for normal early gonadal development. Therefore, this study aimed to determine whether 3-week-old offspring born to anti-LH-treated dams exhibit changes in gonadal tissue development. Overall, findings indicate that early exposure to anti-LH antibodies does not significantly alter gonadal tissue structure by 3 weeks of age. Future directions are to examine mouse pups at later ages to determine whether subtle early changes may progress into more noticeable reproductive effects.

Title: Can Metal Doped Biochar Reduce Phosphorus Loss from Cover Crops?

Primary Author: Gibi Thomas

Additional Authors: Rishi Prasad;Debolina Chakraborty;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Cover crops provide multiple agronomic and environmental benefits; however, their termination and subsequent decomposition can release substantial amounts of nutrients, particularly phosphorus (P), into the soil. During rainfall events, this P may be mobilized via surface runoff, potentially impacting surface water quality. Biochar has recently gained attention for its ability to adsorb nutrients and minimize the risk of P loss. Yet the limited anion sorption capacity of commercial biochar restricts its effectiveness in P retention. Research has shown that modifying biochar with metal oxides can significantly enhance its P retention capacity. Therefore, the objective of this study was to evaluate the effectiveness of both commercial and metal-doped biochar in mitigating P loss from cover crop decomposition in no-till agricultural soils. Commercial pinewood biochar was procured from a local vendor and modified using 1 M $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ (Fe-doped) and 1 M $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ (Mg-doped) to produce two engineered variants. The experiment is set up in a controlled environment in a greenhouse using Decatur silty clay loam soil samples from a no-till system. The soil samples were placed in rainfall simulation pans with dimensions 0.5m×0.3m×0.06m. Hairy vetch <<Vicia villosa>> and cereal rye <<Secale cereale>> were planted at rates of 44 and 100 kg/ha, respectively, in the pans. The cover crops were terminated 90 days after planting, and the residues were left on the soil surface to decompose. Biochar treatments were applied to the trays seven days prior to rainfall simulation. Rainfall simulations equivalent to one-acre inch were conducted following termination, and the collected water samples were analyzed for dissolved reactive P (DRP) and total P. Biochar characterization revealed that iron and magnesium-doped biochar showed enhanced structural and functional properties, and improved P retention, while cover crop species influenced P loss and water quality.

Title: The impact of trauma-informed design on a restorative residential housing community.

Primary Author: Grace Adams

Additional Authors: Katherine Arnold;

Mentor: Anna Ruth Gatlin

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This project examines how trauma-informed design (TID) principles can be applied to a small-scale residential community of multiple tiny home cul-de-sacs that support women's re-establishment of independence in navigating critical life transitions. Drawing from principles of trauma-informed design, the project site placement utilizes biophilia and strongly embraces the connection and interaction with nature as a means of promoting recovery and self-fulfillment. The cul-de-sacs' outdoor areas utilize principles of community, nature, and personal choice by providing separate areas for solo or communal recreation, giving residents the option to connect with others in the community while balancing individual space. As TID promotes inclusion of spaces that allow for solitary retreat, each resident's bedroom will be enclosed from all other rooms to allow mental and physical separation from other occupants in the house. All bedrooms will have storage space for personal items, reinforcing a sense of ownership. Recognizing TID's intent on connecting to the natural world, ample window space will be prioritized in each house to provide views of the outdoors. The project responds to the challenge of creating housing that avoids institutional-like environments while ensuring standard safety measures are implemented. It takes a theoretical approach by questioning how previous research on trauma and trauma-informed design can be applied as physical solutions under the constraints of small-scale housing. The project culminates in a comprehensive site plan, detailed floor plans, and three-dimensional renderings that demonstrate how thoughtful design can function as an active support system, reinforcing stability, healing, and long-term resilience within a restorative residential setting. The results anticipate that the women report a sense of security, community, and autonomy while inhabiting these tiny homes.

Title: Spirit in Motion: Investigating Temporal-Spatial Learning in Tiger Eyes Visual Ensemble

Primary Author: Grace Greer

Additional Authors: Jaimie Roper; Kenneth Harrison; Marigrace Crossett; Ak Black;

Mentor: Jaimie Roper

Department/Program: School of Kinesiology

College: College of Education

Abstract: Highly trained individuals demonstrate superior automaticity of motor skills, reducing attentional demands during complex movements. Collegiate flagline performers, who execute synchronized routines requiring precise coordination and divided attention, may exhibit enhanced cognitive motor integration during walking. This study examined whether flagline training attenuates dualtask interference on ankle energetics compared to recreationally active young adults. Fourteen younger female adults (7 flagline members: 20.8 ± 1.2 years; 7 sex-matched controls: 22.1 ± 1.8 years) walked on an instrumented treadmill at self-selected speed during single-task (ST) and dualtask (DT; verbal fluency) conditions. Three-dimensional gait analysis quantified A2 ankle power peaks, and ankle work ratios (positive/negative work). Independent t-tests compared absolute changes (Δ) from ST to DT between groups. At baseline, groups demonstrated similar A2 ankle power (flagline: 2.61 ± 0.28 W/kg; controls: 2.47 ± 0.31 W/kg; $p=0.38$). A2 ankle power remained stable in flagline members from single-task to dual-task (2.61 to 2.56 W/kg; -2% change) while controls showed moderate decline (2.47 to 2.09 W/kg; -15% change; Δ difference: $t(12)=3.12$, $p=0.009$, $d=1.67$). Ankle work ratios decreased in controls (2.18 to 1.78 ; -18% change) while remaining preserved in flagline members (2.23 to 2.28 ; +2% change; Δ difference: $t(12)=3.68$, $p=0.003$, $d=1.97$). Flagline performers demonstrated superior preservation of ankle function during dual-task walking despite similar baseline mechanics, suggesting enhanced automaticity from specialized training. These findings support the hypothesis that precision movement training enhances cognitive-motor integration, potentially informing interventions to improve stability in populations vulnerable to falls.

Title: Species richness and the prevalence of disease in avian communities

Primary Author: Grace Southerland

Additional Authors: Alex Fisher;Kelsey McCune;Aniruddha Belsare;Luke Watters;

Mentor: Kelsey McCune

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Anthropogenic environmental changes, such as urbanization and domestication, are disrupting all ecosystems on the planet and have also been linked to disease transmission. According to the dilution effect, a higher richness of species will result in lower disease transmission. This effect is increasingly supported at broad scales, but we still lack research on this hypothesis at local scales where spillover of disease to humans occurs. In this study, we seek to determine whether there is a correlation between species richness and disease in the bird populations residing in Lee and Montgomery Counties, Alabama. Target species include year-round residents that are commonly encountered in suburban backyards and at feeders. To gather data to test this, we selected twelve locations to perform species diversity and disease sampling. Each site was categorized as having a bird feeder, chickens, both, or neither. Bird diversity is measured as the number of species detected within 100 meters over the span of the three twelve-minute point count surveys before and after the breeding season. Using this number, sites will be determined to have either high, moderate, or low diversity based on the number of species present at the time. This will be compared to the number of individuals caught in mist nets that have tested positive for disease, which is measured using biological samples that are collected both through cloacal swabbing and collection of expelled feces. These samples are tested for the presence of diseases such as *Escherichia coli* and *Salmonella enterica*. We expect that populations with greater species richness and less frequent contact with domesticated animals will have a lower rate of disease due to the lower probability of pathogens infecting a susceptible host. This information is important to contribute to the understanding of the relationship between disease, domestication, and biodiversity.

Title: Effects of heat and water restriction on zebra finch thermoregulatory behavior

Primary Author: Gracie Bunch

Additional Authors: Margaret McGrath; Haruka Wada;

Mentor: Haruka Wada

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: As global temperatures increase, it is vital to understand how certain species respond to stressors in a changing environment. The zebra finch (*Taeniopygia guttata castanotis*) is susceptible to damage from higher temperatures, as it already lives in the hot, dry grasslands of Australia where lethal hyperthermia is a concern. The zebra finch relies heavily on evaporative cooling for thermoregulation which suggests a need to explore the relationship between water intake and thermoregulation. When these birds are exposed to elevated temperatures, they are less likely to expend energy to re-hydrate themselves. Reduced access to water can shift thermoregulatory behavior away from evaporative cooling via panting or limit how long they can pant to regulate their body temperature. Behavioral analysis is a useful way to further understand heat dissipation strategy under heat stress and water restriction, as behavior changes can be indicators of underlying physiological changes or damage. In this study, female zebra finches were separated into a control group with ad libitum access to water or a water restricted group. Following treatment, both groups were exposed to a 3-hour heat stress (41.5 °C) on two consecutive days. Behaviors of interest included panting, wing spreading, and piloerection. We predict that the water restricted group will rely less on evaporative cooling methods such as panting and wing spreading as their body attempts to conserve water levels.

Title: Urban wood utilization: estimating harvestable timber using Terrestrial Laser Scanning (TLS) and decay assessment

Primary Author: Gunjan Adhikari

Additional Authors: Georgios Arseniou;

Mentor: Georgios Arseniou

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Urban forests are a crucial component in urban ecosystems and also represent a potential source of wood, particularly from standing dead or fallen dead trees due to natural disturbances like storms. These trees are typically regularly monitored and removed for safety and management purposes. However, a major gap exists in accurately assessing their wood volume and potential for wood utilization. Estimating harvestable timber from dead standing trees presents challenges due to internal decay, which frequently results in considerable overestimation of harvestable wood volume when conventional methods are employed. This proposed research aims to establish a methodology for estimating harvestable timber volume in urban forests by specifically estimating the amount of decayed wood of standing or fallen dead and dying trees with the use of Terrestrial Laser Scanning (TLS) technology and other non-destructive techniques, such as resistograph measurements of decay. TLS provides point clouds that can be used to derive measurements of tree structure for precise estimation of tree volumes. However, TLS cannot detect internal wood decay. Therefore, we will include resistograph, measurements of wood decay. The expected results will include estimates of decay-induced volume loss and a framework for predicting volume of decay-adjusted urban timber. Assessing the degree of wood decay in urban trees through this holistic approach, the research will be a framework for supporting the potential of wood utilization in urban areas.

Title: Comparative efficiency of raw and metal-impregnated biochars for Pb and Cd removal in saturated porous media

Primary Author: Gurparshad Singh Brar

Additional Authors: Sushil Adhikari;Atiqur Rahman;Rakesh Kumar;Jasmeet Lamba;

Mentor: Jasmeet Lamba

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Lead (Pb) and cadmium (Cd) contamination in groundwater poses severe risks to both aquatic ecosystems and human health, even at trace levels. This study investigates the adsorption efficiency of pinewood raw biochar (RBC) and magnesium-impregnated biochar (MgBC) for Pb and Cd remediation in saturated porous media. Batch and column-scale experiments were conducted to evaluate adsorption, co-transport, and desorption behaviors of Pb and Cd under varying pH (5.0 ± 0.1 , 7.0 ± 0.1 , 9.0 ± 0.1), ionic strength (0, 10, 50 mM), and humic acid concentrations (0, 10, 50 mg/L), with metal concentrations ranging from 10–50 mg/L at a biochar dose of 50 mg. The experimental data will further simulated using HYDRUS-1D to assess Pb and Cd removal in managed aquifer recharge systems. Results from batch experiment demonstrated that MgBC exhibited superior adsorption capacity and stability across all tested conditions, whereas RBC showed comparable but lower performance. Column experiments will confirm these findings and provide deeper insights into the transport and retention mechanisms of Pb and Cd in saturated porous media. Overall, this study highlights the potential of engineering MgBC as a sustainable adsorbent for mitigating toxic metal contamination in surface and ground waters.

Title: Quantify the influence of poultry litter application and nutrient management on pre-emergence herbicide efficacy in southeastern cotton production.

Primary Author: Gurwinder Singh

Additional Authors: Aniruddha Maity;Rishi Prasad;Rakesh Ghosh;Nisith Nishank Purohit;

Mentor: Aniruddha Maity

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Poultry litter (PL) is an important nutrient source consisting of mixture of manure, spilled feed, and bedding material, with an average fertilizer grade of 3-2-2 (N-P₂O₅-K₂O). It is widely used by farmers in the southeastern United States, including Alabama, due to its easy availability. PL is considered to enhance soil fertility and recycle nutrients for sustainable crop production. However, the PL amendments are expected to alter the soil health and weed control efficacy (WCE) of pre-emergence (PE) herbicides. Preliminary results from a greenhouse study indicated reduced WCE in PL-amended sandy soil. Thereafter, a field experiment was conducted during summer 2025 at the WREC and GCREC research stations to evaluate how PL rate, fertilizer regime, and PE herbicides interact to influence early-season weed emergence in cotton fields. The experiment was designed as a randomized block with three factors: three PL rates (0ton/acre, 2ton/acre, and 4ton/acre), five fertilizer regimes (unfertilized, full NPK, only-N, only-P₂O₅, and only K₂O), and two PE herbicides (acetochlor and pendimethalin). It was observed that early-season weed emergence was positively correlated with PL rates, resulting in lower WCE due to increased adsorption of herbicides by PL. Weed dynamics varied among different fertilizer combinations. Overall, understanding PL-nutrient-herbicide interactions will be essential for sustainable weed control strategies in manure-amended soils.

Title: Association of long non-coding RNA in Bortezomib response in multiple myeloma

Primary Author: Haidyn O'Neal

Additional Authors:

Mentor: Amit Mitra

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Multiple myeloma (MM) is the second most common haematological cancer in the United States and is characterised by malignant plasma cell accumulation in the bone marrow, leading to impaired blood cell production and bone destruction. Although the proteasome inhibitor Bortezomib (Velcade) is a standard therapy that has improved outcomes, treatment response varies because many patients develop drug resistance. Emerging evidence suggests that long non-coding RNAs (lncRNAs), regulatory RNA molecules involved in gene expression and cancer progression, may play a role in therapeutic response, yet their functional contribution to Bortezomib resistance remains unclear. This study investigates the role of lncRNAs in Bortezomib sensitivity using multiple myeloma cell lines representing drug-sensitive and drug-resistant phenotypes. Methods include in vitro cytotoxicity assays to assess response, followed by whole-transcriptome RNA sequencing and bioinformatic analysis to identify differentially expressed lncRNAs. Candidate lncRNAs are evaluated through functional validation assays, including proteasome activity and RNA immunoprecipitation analyses. Preliminary cytotoxicity assays demonstrate variable responses to proteasome inhibition, with resistant cells exhibiting higher IC50 values. RNA-sequencing has identified several lncRNAs differentially expressed between phenotypes, and pathway analysis is ongoing. Functional validation suggests modulation of select lncRNAs may influence Bortezomib sensitivity, though replicate trials continue to confirm reproducibility and mechanistic relevance.

Title: Construction of a pressure vessel for laser scattering measurements of supercritical CO₂

Primary Author: Hailey Livesay

Additional Authors: James Michael;

Mentor: James Michael

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Transcritical and supercritical fluid behavior displays potential advantages for application in aerospace propulsion. The thermodynamic critical point of any fluid marks the end of clear separation between the gas and liquid phases. Every fluid has a specific critical temperature and pressure, and when both are exceeded, the fluid turns supercritical. If only the critical temperature is exceeded, the fluid turns transcritical. Supercritical fluid has some gaseous properties, such as no surface tension, high diffusivity, and low viscosity, while also having density values that are between gas and liquid states. These properties are relevant for propulsion systems that operate at high pressures, such as liquid rocket engines, where propellants are injected under supercritical or transcritical conditions. Utilizing a cell where the pressure and temperature can be set and maintained, liquid CO₂ is brought to the critical point. Optical sights on the ends of the cell allow for measurements to be taken by a laser. This configuration enables observation of the behavior of CO₂ throughout the entire heating and cooling process to reach the critical point. Once the setup proves reliable and repeatable, the study can be replicated for a broader range of fluids relevant to propulsion applications. The goal of this study is to improve the understanding of transcritical and supercritical fluid dynamics. A deeper understanding of these dynamics reduces the uncertainty in fluid behavior and supports the development of more efficient propulsion systems.

Title: Increasing a Sense of Place in Hospitality Interiors through Modular Co-working Spaces

Primary Author: Hailey Pierce

Additional Authors:

Mentor: Anna Ruth Gatlin

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: In recent years, hospitality spaces (hotels, restaurants, etc.) have experienced a rapid increase in digital features, including mobile check-ins, digital concierge services, and technology-driven amenities. These changes have reduced opportunities for meaningful human connection, decreasing guest social interaction, reshaping spatial use, and altering users' sense of place. This research examines how the growing integration of digital technology impacts the guest experience, particularly through decreased opportunities for face-to-face interaction and community engagement. Through an analysis of existing literature on co-working spaces within hotels, these environments are evaluated as successful models for balancing functionality with intentional opportunities for human connection. Emphasis is placed on spatial layout, furniture arrangement, materiality, and sensory experience as design tools that encourage social interaction while offering an alternative to constant digital engagement. This study further investigates how "sense of place" is defined within the context of hospitality design and the role of physical space in facilitating meaningful social encounters. The purpose of this research is to identify and integrate design strategies that intentionally prioritize direct human interaction, social engagement, and a renewed sense of place within hospitality environments. Outcomes include the development of a prototypical co-working space that transitions into an evening social environment, alongside adaptable design strategies such as flexible programming, shared communal zones, tactile and biophilic material applications, and lighting strategies that support comfort and conversation. These findings aim to inform hospitality designers seeking to create spaces that counter digital isolation and foster community, belonging, and memorable experiences.

Title: Property characterization of biochar reinforced polypropylene composites

Primary Author: Haiqiu Jiang

Additional Authors: Yucheng Peng;Thomas Elder;Ke Zhan;

Mentor: Yucheng Peng

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Polypropylene (PP), a thermoplastic, has a wide range of applications due to its low cost, lightweight nature, and chemical resistance. However, its lower performance on mechanical and thermal properties has limited its potential applications in the automotive industry. Therefore, enhancing the performance of PP is important, as it helps reduce costs, expand industrial applications, and improve material efficiency. This research aims to explore incorporating biochar, a carbon-rich material obtained by carbonization of biomass waste, into PP to effectively enhance the overall performance of PP composites. Maleic Anhydride-grafted Polypropylene (MAPP) is used as a compatibilizer to improve composite performance, acting as a bonding agent to enhance adhesion between PP and biochar. The loading levels of biochar used in the composites were 20, 30, and 40 weight percentage (wt.%). The morphological, mechanical, and thermal behaviors of the composites were characterized. The mechanical properties of the composites improved after adding biochar, and the incorporation of a compatibilizer further enhanced the mechanical properties, including flexural strength, flexural stiffness, tensile strength, and tensile stiffness. The thermal property characterization showed an increase in the crystallization peak temperature of PP upon the addition of biochar. The melting temperature and the degree of crystallinity (the fraction of the ordered molecules in the material) of PP remained largely unchanged. The results provide a strategy for exploring the potential application of waste biomass material in polymer composites to improve the performance and to reduce the cost in the automotive industry.

Title: Internal Phosphorus loading in lakes: Geochemical pathways and water quality implications

Primary Author: Halangoda Gedara Dulshika Madushani Dassanayake

Additional Authors: Rishi Prasad;Matt Waters;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Eutrophication remains a persistent threat to lake ecosystems worldwide, largely driven by excessive nutrient enrichment, especially nitrogen (N) and phosphorus (P). Unlike N, which can be permanently lost through gaseous pathways, P lacks a significant gaseous phase and therefore accumulates in sediments as a part of long-term geologic cycling. As the primary limiting nutrient for phytoplankton growth in freshwater systems, P plays a critical role in regulating lake productivity. In aquatic environments, sediments function as both a source and sink of P. When sediment biogeochemical conditions shift, previously stored P can be released back into the overlying water column. This remobilization is tightly linked to the specific chemical forms of P and the minerals to which it is bound. Even after external P inputs are effectively reduced, legacy P in sediments can be released under anoxic conditions, sustaining internal loading and prolonging eutrophication for decades. This study investigates the forms and distribution of P in lake sediments to assess the potential for internal P loading and its implications for water quality. Sediment cores were collected from a depositional zone using a gravity corer. Sequential P fractionation was performed to quantify five P pools: loosely sorbed P, redox-sensitive P, P bound to Fe and Al oxides, apatite-bound P, and residual P. Findings indicate that Al/Fe-P constitutes the largest proportion of sediment P, whereas labile P represents the smallest pool, highlighting the strong association of P with relatively stable mineral phases. Most of the labile P in the sediment was in inorganic form. These findings highlight the pivotal role of sediment geochemical processes in regulating P dynamics in lake systems and underscore the need to consider sediment-derived P when developing effective lake management and restoration strategies.

Title: Biomechanical Ergonomic Assessment for Injury Prevention in Healthcare Professionals

Primary Author: Haley Duncan

Additional Authors: Michael Zabala; Ivan Nail Ulloa;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Healthcare workers, particularly nurses, routinely perform physically demanding tasks such as lifting, transferring, and repositioning patients. These activities place them at elevated risk for work-related musculoskeletal disorders (WMSDs), which occur at higher rates in healthcare than in many traditionally physically demanding industries. Beyond individual injury, WMSDs contribute to workforce absenteeism, increased workload for remaining staff, out-of-pocket medical expenses for injured workers, and substantial economic burden within healthcare systems. Collectively, these impacts emphasize the need for improved methods to quantify and mitigate injury risk during patient-handling tasks. Despite this need, healthcare workers remain underrepresented in biomechanical research examining cumulative exposure over time. This study addresses this gap by characterizing cumulative biomechanical exposure among nurses during real-world patient-handling activities at East Alabama Medical Center (Opelika, AL) using wearable inertial motion capture (IMC) technology. Biomechanical data collected from the IMC will be analyzed in conjunction with self-reported musculoskeletal symptoms and epidemiological risk factors. Motion data will be processed using biomechanical modeling and a fatigue failure framework will be used to estimate cumulative loading of the lower back and related joints. By integrating objective movement data with epidemiological information, this pilot study seeks to develop the first cumulative biomechanical exposure profiles of healthcare professionals in this local clinical setting. Findings are expected to inform targeted ergonomic and educational interventions and support injury prevention strategies aimed at improving occupational health outcomes for healthcare workers.

Title: Integrating Hyperspectral Imagery for Non-Destructive Biomass Prediction in Cover Crops

Primary Author: Hamid Syed

Additional Authors:

Mentor: Tanzeel Rehman

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Quantifying biomass in cover-crop systems remains one of the biggest challenges in sustainable agriculture, where decisions about grazing, nutrient cycling, and carbon management depend on timely and accurate measurements. Traditional clip-and-weigh methods are destructive, slow, and costly, limiting their scalability for research and production monitoring. To address this gap, we developed a hyperspectral imaging pipeline integrated on an unmanned ground vehicle to predict biomass of crimson clover and oat mixtures under field conditions. Calibrated hyperspectral data (400-1000 nm) underwent reflectance normalization and spectral smoothing to derive vegetation indices and latent features. Using partial least squares regression (PLSR) and random-forest models, spectral responses were correlated with ground-truth biomass obtained from destructive sampling. The optimized PLSR model achieved $R^2 = 0.956$, $RMSE = 0.034 \text{ kg m}^{-2}$, and $\text{bias} = -0.012 \text{ kg m}^{-2}$, demonstrating robust predictive accuracy and generalization across plots and dates. Bland-Altman analysis confirmed agreement within $\pm 1.96 \text{ SD}$, validating non-destructive prediction reliability. The resulting AI-driven hyperspectral framework substantially reduces labor and sampling time while providing high-resolution biomass maps to support real-time decision making in cover crop management. By merging machine learning with field robotics, this study contributes a scalable pathway toward data-intensive sustainable phenotyping.

Title: Turning waste cooking oil into high-Performance biolubricants: a multi-Step catalytic process with reaction kinetics

Primary Author: Hanieh Najafi

Additional Authors: Sushil Adhikari; Hossein Jahromi;

Mentor: Hossein Jahromi

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The present study successfully demonstrates an integrated catalytic process for converting waste cooking oil (WCO) into eco-friendly biolubricants with enhanced physicochemical properties. This work employs a multi-step catalytic process, including hydrolysis, dehydration/ketonization, Friedel-Crafts acylation/alkylation, and hydrotreatment. In addition to process development, the reaction kinetics of the hydrolysis step were investigated to provide quantitative insight into a key reaction within the overall catalytic pathway. The hydrolysis of triglycerides was studied under excess water conditions over a temperature range of 250-310 °C and was successfully described using a pseudo-first-order kinetic model with respect to triglyceride concentration. The obtained rate constants exhibited clear Arrhenius behavior, yielding activation energies of approximately 18 kJ mol⁻¹ for WCO and 24 kJ mol⁻¹ for fresh cooking oil (FCO), highlighting the enhanced reactivity of WCO. The kinetic analysis presented here establishes a quantitative basis for extending kinetic modeling to subsequent catalytic steps within the same reaction pathway. At the end of the integrated process, different characterization techniques confirmed a pour point of -12 °C, viscosity of 47.5 cP (at 40 °C), a viscosity index (VI) of 186, and a Noack volatility (evaporative loss) of 17 wt%, surpassing conventional lubricants.

Title: Informing Adaptation of DBT Skills Groups for Interpersonal Violence Survivors: Transdiagnostic Symptoms, Treatment Barriers, and Impressions

Primary Author: Hannah Sawyer

Additional Authors: Emma Lathan-Powell; Tracy Witte; Hailie Suarez-Rivas; Emily Lubin; Jessalynn Ellis;

Mentor: Emma Lathan-Powell

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Interpersonal violence (IV) is a pervasive concern associated with many deleterious outcomes, including greater risk for experiencing mood, anxiety, and substance use disorders. Dialectical Behavior Therapy (DBT) skills groups are particularly well-suited to address transdiagnostic and do so through the dissemination of skills in emotion regulation, distress tolerance, interpersonal effectiveness, and mindfulness. DBT skills groups may be particularly efficacious for IV survivors, who demonstrate elevations across transdiagnostic domains and often are subjected to the unique challenges associated with IV such as legal involvement, contact with the perpetrator, housing/food/job insecurity, and legal/medical fees. Despite DBT skills groups potential utility for survivors, no studies to date have preemptively assessed IV survivors' needs, barriers, and attitudes towards DBT skills groups. In line with the Assessment and Decision phases of the ADAPT-ITT framework, the present aims include: determine the presence of transdiagnostic symptoms and barriers to DBT skills groups, impressions of groups, and whether groups need to be adapted prior to dissemination among IV survivors. 150 IV survivors ($M(SD)$ age = 39.06(10.42), 66.7% women, 74% White) completed a 90-minute online survey via Prolific. Survivor responses to the Difficulties in Emotion Regulation Scale-Short Form, Distress Tolerance Scale and adapted/researcher-created questions were evaluated. IV survivors demonstrated elevated emotion dysregulation and reduced distress tolerance compared to non-clinical samples and endorsed significant barriers to groups. Further, most survivors felt like DBT would be helpful for IV survivors (extremely helpful, 68%) and indicated that they would participate in DBT skills groups only after adaptations have been made for IV survivors. The present study represents a critical step towards utilizing survivor-centered research approaches to creating a model of care that is responsive to the needs and considerations of IV survivors, identified by IV survivors themselves.

Title: A molecular chemistry framework to assess processing intensity in poultry products based on intermolecular forces and protein buffering responses

Primary Author: Harleen Kaur

Additional Authors: Thiago Belem; Rudro Deb Sardar;

Mentor: Amit Morey

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Further processing of poultry meat involves the incorporation of approved ingredients and thermal treatment; which can re-establish intermolecular forces (IMFs) in proteins. These chemical interactions govern protein behavior during digestion and may influence associated health outcomes. Quantifying changes in IMFs can serve as an objective indicator of degree of processing; however, this approach is rarely considered in food classification systems. The present study aims to investigate fundamental IMFs and their processing-induced alterations in poultry products. Commercially produced, fully cooked, frozen whole-muscle (WM) and formed (FM) chicken nuggets were used throughout the study. Chicken nuggets were reconstituted in air-fryer (AF) and microwave (MW) as per the brand instructions. Breeding was removed and the nugget meat was used for analysis. Textural parameters of nuggets were analyzed by TPA-cylindrical probe (50mm), gastric buffering capacity (GBC) by titrating homogenized tissue with 0.5 M HCl to pH 2.0. The insoluble meat pellets obtained were neutralized to pH 5.7 and corresponding weight gain was recorded. Data for IMF destabilization mediated proteins extractability was collected, and proteins were quantified by Bradford assay and SDS-PAGE. Data were analyzed using JMP with Tukey's HSD ($P < 0.05$). Results indicated that FM nuggets had lower GBC than WM nuggets in the baseline and both re-heating methods (e.g., 35 vs 60 mEq/100 g for thermal pre-processed). IMF profiling showed greater force-resistant fractions in WM (20-26 mg/g of sample protein in disulfide-targeting MW extracts) than FM (<17 mg). Neutralized MW pellets partially restored solubility but retained more IMF-stabilized protein in WM. Collectively, analyses indicated that WM nuggets maintain stronger structural interactions than FM products and MW reconstitution intensifies these features more than AF providing a molecular basis for defining the degree of processing.

Title: Investigating the role of head domain swivel in 40S ribosomal subunits during translation

Primary Author: Haylee Cook

Additional Authors: Megan Fitzgerald;

Mentor: Alexey Petrov

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Proteins play a crucial role in all aspects of life. Disruptions and dysregulations of protein production are linked to almost all forms of disease. Translation is executed by the macromolecular machine called the ribosome. The head of the small ribosomal subunit is a mobile domain of the ribosome. Head movements accompany key reactions of the translation cycle - initiation, tRNA selection, translocation and termination. Translational regulatory events, as well as translational errors, are correlated with abnormal head position or incomplete head movements. To reveal the role of the head dynamics in translation, we want to follow conformational changes in real time using Förster Resonance Energy Transfer (FRET). FRET efficiency is inversely proportional to the distance between two fluorescent dyes. FRET requires site-specific attachment of fluorescent dyes. To follow head movements, we decided to use labeled RPS12 and mRNA. RPS12 is a ribosomal protein near the mRNA entry channel on the 40S ribosome that is located on the beak of the head domain. It moves by 5-10 Å – a distance change well suited for the FRET measurements. The goal of my project is to label RPS12 with fluorescent dyes, validate resulting FRET signals, and observe head movements during translation in future single-molecule experiments.

Title: Typical Music Levels Measured In Auburn University Marching Band Students

Primary Author: Hayley Platt

Additional Authors: Sarah Ferguson;

Mentor: Sridhar Krishnamurti

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Marching band students are often exposed to high noise levels, which increases their risk of hearing damage. Evaluation of these sound levels and offering hearing protection can decrease the possibility of acquiring hearing loss later. This study was used to measure typical music levels among Auburn University Marching Band Students. Two Auburn University students' hearing was recorded over a two-hour rehearsal using the National Institute for Occupational Safety and Health (NIOSH) app. This app allows any individual to test noise levels in their environment to ensure that they are not exposed to hazardous noise. The noise levels were measured using four measurement types- time weighted average (TWA), LAeq, projected noise dose, and range. A result of 77.7 dB was measured for the time-weighted average over the 2-hour duration of the recording. This TWA shows little risk. The equivalent noise exposure over 8 hours (LAeq) calculates what the noise exposure would be if it continued for a full workday (8 hours). This measurement estimated to be about 86.8 dB, exceeding noise levels considered safe. According to NIOSH, noise levels over 85 dB for 8 hours indicate risk for hearing loss. The projected noise dose, which is an estimate of how much noise your ears will be exposed to by the end of the day, was 146.3%, exceeding the 100% noise dose, warranting hearing protection per OSHA. Lastly, rehearsal sound levels typically ranged from 90 to 105 dBA. This range of noise levels can be harmful to the ear. These results show that without hearing protection, the risk of acquiring hearing loss is greater. Although the band members may not experience direct repercussions now, it is important to raise awareness of hearing damage caused by noise exposure so they can lessen their risk of hearing damage later.

Title: UDP-Glucuronosyltransferases: Implications for Tumor Progression and Therapeutic Response

Primary Author: Helen Burgess

Additional Authors: Gary Piazza;Kristy Berry;Yulia Maxuitenko;Xi Chen;Junwei Wang;Adam Keeton;

Mentor: Adam Keeton

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: UDP-glucuronosyltransferases (UGTs) are a superfamily of phase II drug-metabolizing enzymes that catalyze the conjugation of glucuronic acid to lipophilic substrates, promoting detoxification and clearance of xenobiotics and endogenous metabolites. Although UGT-mediated metabolism is well-studied in pharmacokinetics, its impact on cancer therapy has only recently been recognized. Emerging clinical and preclinical evidence suggests that altered UGT expression and activity represent an underappreciated mechanism of cancer resistance, causing reduced therapeutic efficacy across multiple cancer types. UGTs can be inducibly upregulated in response to treatment and contribute to either intrinsic or acquired resistance by metabolically inactivating anticancer agents and reducing intracellular levels of active drug. Elevated UGT expression has been associated with poor therapeutic response and adverse patient outcomes, highlighting its clinical relevance as predictive and prognostic biomarkers. In this poster, we draw upon a published review to examine key mechanisms underlying UGT-mediated resistance, including pharmacogenetic variability, inducible UGT expression following drug exposure, and metabolic inactivation of anticancer agents by glucuronidation. We also discuss evidence that altered regulation of endogenous metabolites may further influence therapeutic response. Within this framework, we further demonstrate that sensitivity to ADT-007, a pan-RAS inhibitor, correlates with UGT expression in RAS mutant and RAS wild-type (WT) cancer models, illustrating how UGT-dependent metabolism can shape drug selectivity and anticancer efficacy. Collectively, existing clinical and preclinical evidence, together with our ADT-007 findings, support the premise that UGTs act as critical modulators of therapeutic response and highlight UGT-mediated pathways as potential targets to overcome drug resistance and improve cancer treatment outcomes.

Title: Alterations in Gonadotropin Levels During Minipuberty in Mouse Pups Exposed to Anti-Luteinizing Hormone Antibodies

Primary Author: Henry Archer

Additional Authors: Aime Johnson; Douglas Martin;

Mentor: Arthur Zimmerman

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Puberty is a developmental period of progression toward sexual maturity, typically resulting in fertility. Importantly, pubertal onset is directly linked to and dependent upon appropriate function of the hypothalamic-pituitary-gonadal (HPG) axis. Specifically, gonadotropin-releasing hormone (GnRH) from the hypothalamus is secreted in a pulsatile manner, and pituitary gonadotropins, luteinizing hormone (LH), and follicle-stimulating hormone (FSH). These gonadotropins support gametogenesis and regulate sex steroid hormone secretion, leading to sex-specific physical changes. Puberty onset typically begins between 8-13 years of age in females and 9-14 years of age in males, and these variations are due to a multitude of complex factors including proper activation of the HPG axis during development. Indeed, activation of the HPG axis also occurs both in fetal life during the second trimester and postnatally, beginning at 2 weeks in humans, during an event called minipuberty. Specifically, minipuberty is both important and necessary for priming the HPG axis to attain proper pubertal onset and reproductive viability and may play a role in brain development, formation and maintenance of sensory systems, namely olfaction and hearing, and normal cognitive function later in life. However, minipuberty has only been partially characterized in a few mammalian species, and very little work has examined the potential effects of alterations in hormone signaling during this period. Therefore, given the broad importance and impact of minipuberty, we examined changes in hormonal signaling during this period in CD1 mouse pups exposed to maternally derived anti-LH antibodies prior to weaning. Gonadotropin levels were measured in both male and female mouse pups, and future studies will examine any behavioral, reproductive, and/or cognitive effects of altered minipuberty.

Title: Uptake of PFAS and nitrogen in corn grown on biosolid-amended soils

Primary Author: Hikmat Paudel

Additional Authors: Soura Gupta;Rishi Prasad;Debolina Chakraborty;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Biosolids are stabilized organic residuals generated during wastewater treatment and processed to reduce pathogens and odors. When applied to land, they serve as a sustainable source of nutrients and organic matter, supporting soil productivity. Biosolids can enhance several aspects of soil fertility, including increases in organic matter, cation exchange capacity, pH, and the supply of essential nutrients such as nitrogen (N), phosphorus (P), and micronutrients. They also improve physical properties by promoting better water retention and aeration. However, biosolids may contain emerging contaminants such as per- and polyfluoroalkyl substances (PFAS), a class of highly fluorinated compounds with strong carbon–fluorine bonds that impart extreme environmental persistence. Their presence has raised concerns regarding PFAS bioavailability and potential transfer into agricultural crops. To assess PFAS movement from biosolid-amended soils into plants and evaluate its relationship with crop N uptake, a greenhouse experiment was conducted using corn as the test crop. The experiment was arranged as a complete block design with varying biosolid application rates and included a control soil with no biosolid application. Plant biomass was harvested, and N and C uptake were quantified. Following harvest, PFAS concentrations in the tissue samples were analyzed. Our findings indicated that Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) were the dominant PFAS compounds present in biosolids. The study will help to explore the translocation of these components into corn grown in biosolid-amended soil, while simultaneously evaluating nutrient uptake. The results will inform management strategies that optimize the agronomic value of biosolids while minimizing associated environmental risks.

Title: Combining Macrophage Modulation, PD-1 Blockade, and 4-1BB Agonism for Triple-negative Breast Cancer Immunotherapy

Primary Author: Himanshi LNU

Additional Authors: Maninder Sandey; Damien Ruiz; Alana Kramer; Jonathan Marable;

Mentor: Maninder Sandey

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Resistance to immunotherapy is driven in large part by the complexity of the tumor microenvironment (TME), which is dominated by immunosuppressive cell populations such as tumor-associated (M2) macrophages (TAMs). TAMs actively restrain antitumor immunity by suppressing effector T cell function, limiting immune infiltration, and reinforcing T cell exhaustion. As a result, cytotoxic T cells remain functionally impaired despite antigen recognition and are unable to mount an effective antitumor response. Overcoming this resistance requires a coordinated strategy that simultaneously relieves inhibitory signaling, delivers activating costimulatory cues, and reprograms the suppressive myeloid compartment. Thus, we hypothesize that PD-1 pathway blockade will relieve inhibitory signaling in exhausted T cells, 4-1BB agonism will deliver a potent costimulatory signal that promotes T-cell expansion and effector function, and reprogramming TAMs from a M2 to an M1 phenotype will remodel the TME to permit effective T-cell-mediated antitumor activity. To implement this approach, murine tri-specific fusion proteins (Mu_Tri_PB832c and Mu_Tri_PLB832c) were engineered to simultaneously engage murine CD206, PD-1, PD-L1, and 4-1BB pathways. Constructs were designed in silico, synthesized, cloned into the SPB-015 expression vector, and stably expressed from Expi293F-based stable cell lines. Recombinant proteins were purified from conditioned media by affinity chromatography. Protein concentration was determined by BCA assay, and purity was assessed by SDS-PAGE and Western blotting. Binding specificity was evaluated using flow cytometry. The purified recombinant proteins exhibited high purity by SDS-PAGE analysis. Under reducing conditions, both proteins migrated at approximately 75 kDa, consistent with the expected monomeric molecular weight, while under non-reducing conditions, bands at approximately 150 kDa were observed, consistent with dimer formation. Functional characterization by flow cytometry demonstrated specific binding of Mu_Tri_PB832c and Mu_Tri_PLB832c to Expi293F cells expressing murine CD206, 4-1BB, PD-1, or PD-L1 receptors. Together, these findings highlight a rational strategy to overcome immunotherapy resistance by integrating checkpoint inhibition, costimulatory agonism, and macrophage modulation.

Title: Racial and ethnic disparities in post-surgical pain management among patients undergoing orthopedic surgery in the United States

Primary Author: Ibrahim Alfayoumi

Additional Authors:

Mentor: Surachat Ngorsuraches

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Postoperative pain management is essential for recovery following common orthopedic procedures. Prior studies primarily emphasized inpatient postoperative analgesic use but did not adequately examine outpatient use across racial and ethnic groups. This study aimed to assess outpatient postoperative analgesic use following major orthopedic surgeries in the United States. We conducted a retrospective cohort study using data from the NIH All of Us Research Program. Adults aged ≥ 18 years undergoing total knee arthroplasty, total hip arthroplasty, or rotator cuff repair were included if they had at least one postoperative analgesic prescription within 30 days of surgery and continuous electronic health record data for ≥ 180 days prior to surgery. Postoperative pain management was classified as opioid versus non-opioid therapy within 30 days after the index procedure. Multiple logistic regression was used to estimate adjusted odds ratios (aORs) for opioid use by race/ethnicity, adjusting for various covariates, e.g., comorbidity and preoperative opioid use. The final cohort included 8,887 patients (mean age 62.6 years; 58.9% female). Overall, 83.0% received opioid therapy, and 17.0% received non-opioid therapy within 30 days post-surgery. Hispanic patients had significantly lower odds of receiving opioids compared with non-Hispanic White patients (aOR 0.46; 95% CI, 0.36–0.60). Odds of opioid use did not differ significantly between non-Hispanic Black and White patients (aOR 1.24; 95% CI, 0.95–1.63). Preoperative opioid use was the strongest predictor of postoperative opioid use (aOR 4.82; 95% CI, 4.05–5.75). Increasing age was associated with higher odds of opioid use, while gender was not significantly associated. Racial and ethnic differences in postoperative opioid use existed following common orthopedic surgeries, particularly among Hispanic patients. These findings underscore the need for equitable, evidence-based pain management strategies for patients undergoing orthopedic surgery.

Title: Game on: Improving children's body composition through Ring Fit Adventure

Primary Author: Ifeloju Ayileka

Additional Authors: Danielle Wadsworth;

Mentor: Danielle Wadsworth

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: This study assessed changes in body composition among parents and children following an 8-week active video game (AVG) intervention using Ring Fit Adventure on the Nintendo Switch. AVGs offer a unique opportunity to merge entertainment with physical activity, and with roughly 190 million Americans aged 5–90 playing video games at least one hour per week, home-based AVGs may be a viable strategy to improve body composition. However, limited research has examined whether home-based AVGs can meaningfully improve body composition in both children and adults. Seven families (9 adults, M age = 44; 8 children, M age = 13) completed an 8-week intervention in which they were asked to play Ring Fit Adventure twice weekly for 30 minutes at home. The game uses a resistance ring and leg strap to guide players through exercise-based movements in an interactive adventure setting. Weekly self-reports captured total play and active exercise time using in-game metrics. Body composition (fat mass, fat-free mass) was measured pre- and post-intervention using a Tanita TBF-400 bioelectrical impedance scale. Children averaged 55 minutes of weekly play (42 minutes of exercise), while adults averaged 22 minutes (11 minutes of exercise). Paired t-tests showed that children significantly increased fat-free mass (pre = 82.42 kg, post = 84.70 kg; $p = .002$, Hedges' $g = 1.1$) and decreased fat mass (pre = 20.81 kg, post = 19.25 kg; $p < .001$, Hedges' $g = 1.0$). Adults showed no significant changes in fat mass ($p = .38$) or fat-free mass ($p = .19$). AVGs incorporating resistance-style training appear to be a feasible and effective strategy for improving body composition in children, who completed nearly the full prescribed dose of gameplay each week; however, similar benefits were not observed in adults. This study is significant because it demonstrates that home-based active video games (AVGs) incorporating resistance-style movements can meaningfully improve body composition in children within a relatively short period. Given the widespread popularity of video gaming across age groups, AVGs represent a scalable, accessible, and engaging strategy to promote physical activity in the home environment, especially for youth who may be less inclined to participate in traditional exercise programs. These findings are important for families, healthcare professionals and public health practitioners seeking innovative approaches to reduce sedentary behavior and support healthy development.

Title: Discrimination of Foodborne Bacterial Pathogens using Liquid Chromatography Ion Mobility Tandem Mass Spectrometry (LC-IM-MS/MS)

Primary Author: Iffat Jerin

Additional Authors: Ahmed Hamid; Adebowale Oyerinde; Kimberly Kartowikromo; Jessica dos Santos Pizzo; Kristen Marshall;

Mentor: Ahmed Hamid

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Foodborne illness remains a major public health challenge worldwide and is primarily caused by the consumption of food contaminated with harmful microorganisms. According to the World Health Organization (WHO), approximately 10% of the global population suffers from foodborne diseases each year, resulting in more than 420,000 deaths. Despite significant advances in food manufacturing practices and safety regulations, foodborne disease outbreaks continue to occur, highlighting the urgent need for accurate and sensitive detection methods for foodborne pathogens. Although a wide range of microorganisms can cause foodborne illnesses, most of those cases and fatalities are attributed to bacterial species such as *Campylobacter*, *Escherichia coli*, *Salmonella enterica*, and *Listeria monocytogenes*. Previous studies have demonstrated the potential of differentiating bacterial species and strains based on their cellular lipid profiles using liquid chromatography–ion mobility–mass spectrometry (LC-IM-MS/MS). This presentation discusses our efforts in developing an accurate detection method for differentiating major bacterial serotypes associated with foodborne illnesses. Two complementary approaches were employed: lipid analysis from individual bacterial cultures and from co-culture samples. Nine bacterial serotypes from three different species were cultured in Luria broth and the lipids were subsequently extracted using a solid-phase extraction method and analyzed using our optimized workflow. Lipid identification was performed using a Personal Compound Database and Library generated through an extensive literature survey. Multiple lipid classes, including PGs, PEs, CLs, lysyl-PGs, DAGs, and DGDGs, were identified and confirmed based on exact mass, isotopic abundance, collision cross-section values, and fragmentation patterns. When combined with principal component analysis (PCA), this platform overcame several limitations of conventional analytical techniques.

Title: What we've been missing: Structural variants in Paroxysmal dyskinesia genes

Primary Author: Inass Ahmed

Additional Authors: Nancy Merner;Emily Graff;Tom Jukier;

Mentor: Nancy Merner

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Paroxysmal dyskinesias (PXD) are rare inherited movement disorders in humans and dogs, typically presenting as recurrent, brief episodes of involuntary hyperkinetic movements without loss of consciousness. Three subtypes are recognized: kinesigenic (PXKD), triggered by sudden movement; non-kinesigenic (PXNKD), associated with stress; and exercise-induced (PXED), triggered by exertion. Multiple PXD genes have been identified in each species, but none overlap. Human orthologs of several canine PXD genes have instead been linked to other rare neurodevelopmental and movement disorders. Many PXD cases remain genetically unsolved, including two affected littermates from a Labrador Retriever pedigree presented to the AUCVM. Whole-genome sequencing (WGS) was performed on the two affected dogs and their unaffected dam. Short nucleotide variants (SNVs) in known PXD genes were first evaluated, but none were identified. Therefore, this study focused on structural variants (SVs), which are less frequently studied. PacBio WGS data were processed using an in-house bioinformatics pipeline. SV analysis targeted 51 genes, including seven associated with PXD or PXD-like phenotypes in dogs and 44 human PXD orthologs. Recessive and potential de novo SVs shared by the affected dogs were prioritized. Of the 152,939 total SVs identified across all three genomes, 298 were located within the 51 assessed PXD genes. Nine SVs followed an autosomal homozygous recessive pattern, and 13 potential de novo heterozygous SVs were shared by the affected dogs but absent in the dam. No X-linked SVs were identified. All SVs were intronic within the PXD genes; however, one SV was also annotated as a deleterious coding deletion in a nested gene, which was completely deleted. Further investigation is required to determine whether the intronic SVs alter PXD gene splicing, thereby affecting gene function or expression, and if the coding SV in the nested gene contributes to PXD.

Title: Rooted in challenges: Identifying Socioeconomic and Barriers to Urban Tree Planting in Alabama Communities

Primary Author: Ioannis Mousios

Additional Authors:

Mentor: Georgios Arseniou

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Urban Forests provide important benefits to city neighborhoods such as environmental, social and health benefits. Trees can regulate local atmospheric temperature, reduce air pollution and they act as barriers to stormwater runoff. In many cases, Urban green infrastructure has been linked to attractive urban aesthetics and a feeling of safety. Successful urban forest expansion depends not only on tree planting projects but also on sustained community participation and proactive tree maintenance. Urban forest expansion can be affected by the perceptions of residents and stakeholders when it comes to risks and tree management, and therefore urban green infrastructure is heavily affected by socioeconomic factors. Many communities in Alabama lack the required resources to maintain tree planting projects along with other public services and trees may be perceived as a potential liability to people and infrastructure during extreme weather events. This interplay between residents and municipal leaders may usually act as a barrier to tree planting projects. Additionally, municipalities usually are not proactive in effectively managing and maintaining urban trees which can have significant economic implications. The aim of this study is to uncover and understand the barriers that rural communities in Alabama face when implementing tree planting projects by employing qualitative research methods. Expected results of this study may include identifying recurring themes such as perceptions of risks for urban trees or the impact of insufficient financial and human resources in urban forest management. This study is being funded by the 'Green Up Alabama' project which aims to assist communities in increasing their Urban Forest canopy, by providing funding to plant new trees and training those who are interested in tree maintenance. Understanding the barriers of such tree planting projects in the state of Alabama will provide a framework for promoting effective engagement of local communities in urban forest canopy expansion efforts under a changing climate.

Title: Optimizing cotton yield through site-specific nitrogen and seeding rate management.

Primary Author: Isaac Buyungo

Additional Authors: Adam Rabinowitz;Eros Francisco;Diego Garcia Ajche;Steve Brown;Emmanuel Abban Baidoo;Brenda Ortiz;

Mentor: Brenda Ortiz

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Optimizing the use of inputs in cotton production is crucial for enhancing farm profitability and environmental sustainability. Many farmers use a uniform management even though their cotton fields exhibit within-field variability. This strategy may result in low yields and inefficient input use. The objective of this study was to quantify cotton yield responses to varying nitrogen and seeding rates across contrasting landscape positions to identify site-specific seed and nitrogen combinations that maximize productivity and input use. The study was conducted in Coffee Springs, Alabama, in 2025. Three nitrogen rates (50, 70, and 90 lb. N acre⁻¹) and four seeding rates (23,000, 26,000, 29,000, and 32,000 seeds acre⁻¹) were evaluated across two topographic zones: a gentle and a steep slope. On the gentle slope, a split-plot design was used. The main plots (80ft X 250ft) consisted of the nitrogen treatments, while the seeding rate treatments were nested into the main plots as subplots (20ft X 250ft). Conversely, a strip-plot design was implemented on the steep slope. Both the seeding and nitrogen rates were applied in long strips across the field; however, four seeding rate strips (@20ft wide) were within one nitrogen rate strip (80ft wide). The trial was planted using a six-row CASE Planter IH 1210 with a 40-inch row spacing. The nitrogen was applied using the CASE Spreader IH SPX 3200 with a Trimble FMX display and Field IQ controller. A CASE Cotton Picker IH Module Express 635 with a Case IH Pro 700 display was used to harvest and record the yield data. Results showed that the gentle zone out-yielded the steep zone with average yields of 1,696 and 1,457lb acre⁻¹, respectively. The highest cotton yield in the gentle zone was achieved with a combination of 90lb. N acre⁻¹ and 23,000 seeds acre⁻¹, and in the steep zone, a combination of 70lb. N acre⁻¹ and 29,000seeds acre⁻¹ maximized yield. The first-year results of this study suggest the potential of site-specific management to enhance yield, input efficiency, and environmental sustainability.

Title: Development and validation of a high-sensitivity qPCR assay for detecting reniform nematodes in soil

Primary Author: Isaac Cardwell

Additional Authors: Kathy Lawrence; Bisho Lawaju;

Mentor: Bisho Lawaju

Department/Program: Horticulture

College: College of Agriculture

Abstract: Reniform nematode (*Rotylenchulus reniformis*) is a persistent constraint to cotton production throughout the southern United States. Current diagnostic approaches rely on extraction and microscopic identification, which are time-consuming and require specialized taxonomic expertise. To improve diagnostic speed, this study focuses on the development of a real-time PCR (qPCR) assay for direct detection of *R. reniformis* DNA from soil. Five primer pairs specific to *R. reniformis* were initially screened using in silico analyses and evaluated by conventional PCR with DNA extracted from individual handpicked reniform nematodes maintained on Phy 340 W3FE cotton under greenhouse conditions. DNA was isolated using an in-house lysis protocol optimized for single-nematode templates. Among the primer sets tested, Ren240F/Ren240R generated strong and reproducible amplification and was selected for SYBR Green-based qPCR assay development. Assay specificity was evaluated using DNA from *R. reniformis* and 12 non-target nematode species representing eight genera commonly encountered in Alabama soils. Amplification was observed exclusively for *R. reniformis*, with no detectable cross-reactivity. Analytical sensitivity and efficiency were determined using serial half-dilutions of DNA extracted from ten reniform nematodes. The resulting standard curve showed a linear relationship between C_q values and log-transformed DNA concentration, corresponding to an amplification efficiency of approximately 103%. The assay reliably detected DNA equivalent to ~0.002 of a single nematode, demonstrating high sensitivity and reproducibility. Ongoing work will assess assay performance using soil DNA spiked with known nematode densities and validate the method with naturally infested field soils. This molecular diagnostic approach offers a rapid and reliable alternative to traditional methods and has the potential to enhance reniform nematode monitoring and decision-making in cotton production.

Title: Antimicrobial discovery from diverse soil samples

Primary Author: Isabelle Brogden

Additional Authors: Michelle Gibbs;

Mentor: Michelle Gibbs

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Antibiotic resistance is one of the top global public health threats, directly responsible for over one million deaths annually. Antibiotic resistance is particularly severe in hospital settings, with infections such as Methicillin-resistant *Staphylococcus aureus* (MRSA) becoming increasingly dangerous. The rise of antibiotic-resistant pathogens has created an urgent need for new antimicrobial compounds. This undergraduate research project, inspired by the Small World Initiative, aims to discover novel antibiotic-producing microorganisms from local soil samples. The study integrates microbiological techniques with molecular genetics to identify and characterize bacteria capable of producing antimicrobial agents. This project aims to understand the genetic basis of antimicrobial production and to identify the biosynthetic pathways organisms use to produce antimicrobials. To achieve this, we collected soil samples and isolated 182 bacteria from four soil samples using colony morphology. We tested for antimicrobial activity using competitive growth assays against safe versions of pathogenic strains: *E. coli*, *S. epidermidis*, *B. subtilis*, or *P. granadensis*. In this assay, soil isolates are plated in half-inch increments on a lawn of each tester strain, spaced far enough apart to observe a zone of inhibition (indicating antimicrobial activity). Of the four initial soil samples taken, six bacterial isolates inhibited the growth of at least one of the four tester strains (*E. coli*, *S. epidermidis*, *B. subtilis*, or *P. granadensis*). These include isolates 2-Sample 2, 14A-Sample 2, 30B-Sample 1, 34-Sample 2, 55-Sample 3, 56-Sample 1, and 57A-Sample 0. These isolates represent diverse soil bacteria and exhibit activity against both Gram-negative and Gram-positive model organisms.

Title: Workforce characterization and biopsychosocial predictors of musculoskeletal symptoms in salmon-processing workers in southern Chile: a cross-sectional study using sparse learning

Primary Author: Ivan Enrique Nail Ulloa

Additional Authors: Roberto Molinari;Michael Zabala;Mia King;Saim Siddiqui;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Work-related musculoskeletal disorders (MSDs) are common in aquaculture, yet integrated evidence on workforce characteristics and biopsychosocial predictors of symptoms is limited for Chilean salmon-processing plants. We conducted a cross-sectional study in a salmon-processing facility in Puerto Montt, Chile (March to July 2024). One hundred workers completed surveys on demographics and work history, health and psychosocial factors, and sleep, followed by anthropometrics and grip-strength testing. Outcomes were self-reported 12-month pain and treatment seeking for the low back, shoulder, and distal upper extremities. Predictors included sleep deficit, weekend catch-up sleep, and grip strength. To prioritize parsimonious predictor sets, we used LASSO-penalized logistic regression and the Sparse Wrapper ALgorithm (SWAG), then refit logistic models for interpretability. Across outcomes, sparse selection (LASSO/SWAG) repeatedly prioritized sleep-related variables, including sleep quality and sleep recovery (catch-up sleep), and low-back pain models additionally prioritized sleep-deficit indicators. Upper-extremity pain models also frequently selected dominant-hand grip strength alongside sleep variables. These patterns raise questions about how sleep recovery and physical capacity relate to pain in cold, repetitive work. This work supports data-driven screening that integrates recovery and capacity, motivating mechanistic and longitudinal studies to test temporal and causal pathways.

Title: Conditional auxotrophy reveals pathogenic contributions of native conformations of bacterial derived antigens upon exposure to sea urchin larvae.

Primary Author: Jackson Wells

Additional Authors: Katherine Buckley; Jake Tatum;

Mentor: Katherine Buckley

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: *Vibrio* species are a diverse group of marine bacteria that cause numerous pathologies in marine invertebrates. In purple sea urchin (*Strongylocentrotus purpuratus*) larvae, infections by different *Vibrio* species can elicit differing immune responses. *Vibrio diazotrophicus* induces a robust, yet non-lethal, inflammatory response. *Vibrio splendidus* infections typically result in fatality. Larval immune activation is characterized by immune cell migration and rapid production of cytokines such as IL-17. These factors make sea urchin larvae incredible models for studying the innate immune response. Despite clear and quantifiable differences between live infection phenotypes, exposure to heat- or chemically killed *Vibrio* results in minimal immune activation in larvae. This discrepancy suggests that pathogenicity may depend on native conformations of virulence-associated proteins disrupted by conventional killing methods. To address this problem, this project employs the use of conditionally auxotrophic strains of *V. splendidus* and *V. diazotrophicus* lacking *dapA*, an essential gene for bacterial cell wall biosynthesis. This method retains vital protein structures while eliminating membrane integrity. Sea urchin larvae will be exposed to living wild-type, heat-killed, and auxotrophic strains. Immune responses will be assessed using in-vivo imaging to quantify immune cell migration and gut inflammation, alongside analysis of immune gene expression. We hypothesize that exposing the larvae to these auxotrophic mutants will illicit immune responses like wild-type infections, reflecting that activation of immune response and initial cytokine signaling is due to innate bacterial proteins. This work aims to elucidate the virulent antigens associated with *Vibrio* infections and their respective immune responses. As fellow deuterostomes with conserved innate immune system responses, this work may inform broader host-microbe interactions in humans and other animals

Title: Exploring the role of copper in the purple sea urchin larval immune response

Primary Author: Jackson Wurth

Additional Authors: Amelia Williams;

Mentor: Katherine Buckley

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Copper is an essential micronutrient Echinoderms offer an advantageous model for investigating the pathways that ultimately lead to vertebral adaptive immunity. *S. purpuratus* larvae respond to infection by *Vibrio diazotrophicus* through a progression of recognition to immune response, creating pigmented immune "vesicles" in response. Our research progressed from understanding the initial onset for this immune response to focusing on understanding the specific aspects that assist this process, specifically the necessity of copper. This was achieved through the addition of BCS (Bathocuproine disulfonate) copper chelator and utilizing a washing schedule to remove excess copper within the Artificial Seawater (ASW), in which the larvae were immersed. Preliminary results indicate a small correlation for the effects of copper between the BCS infected and ASW infected subjects, however this is a rather small correlation. More research is needed and further research using TPEN, a membrane-permeable copper chelator, is planned to remove stored copper that BCS, not membrane-permeable, was unable to bind. This will provide more robust evidence concerning the link between copper and the immune response within *S. purpuratus* under bacterial load. This work attempts to offer explanations for the necessity of copper within the echinoderm immune system and to animal immune systems broadly.

Title: Design and Test of an Augmented Spark Igniter with Interchangeable Flow Control Orifices

Primary Author: Jacob Davies

Additional Authors: Ari Goldman;

Mentor: David Scarborough

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Auburn University Combustion Physics Lab has designed, assembled, and hot-fire-tested an augmented spark igniter concept with NASA Marshall Space Flight Center (MMMMMMM), using gaseous OO_2 and $MMCC_4$ propellants. As part of the rotating detonation rocket engine test campaign at MMMMMMMM, researchers designed the igniter to operate under extreme mixture ratio and chamber pressure conditions. The igniter design meters supply propellants at counterposed inlets through the choking of interchangeable orifices. The use of interchangeable flow metering orifices allows for a shared propellant supply with the main engine combustion chamber while enabling independent control of igniter mixture ratio and igniter chamber pressure. The assembly called for off-the-shelf components to create a low cost and easily repeatable design. We measured the effective flow areas of the interchangeable flow metering orifices. A sparkplug is set with the electrode extending into the center of the igniter, near the propellant impingement location, and discharges to the body of the igniter combustion chamber. We test and provide results for both low and high-pressure igniter variants in this study. We calculated propellant supply rates using mass flow choking equations with isentropic assumptions, and we referenced NASA Chemical Equilibrium Applications for combustion properties.

Title: Effects of Aquaponic System Design on Sensory and Instrumental Quality of Cherry Tomatoes

Primary Author: Jacob Dees

Additional Authors: Brendan Higgins;Shima Rezaei;Michelle Hayden;Jihye An;

Mentor: Sungeun Cho

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Aquaponics integrates aquaculture and hydroponic plant production and is often promoted as a resource-efficient food system. Although system design can alter water chemistry and plant growth, it is unclear whether these differences lead to noticeable changes in produce quality. This study examined how aquaponic loop configuration and harvest timing influence the sensory and instrumental quality of cherry tomatoes (*Solanum lycopersicum*). Sensory quality refers to human-perceived attributes (aroma, flavor, texture), while instrumental quality includes objective measurements of color, firmness, and volatile profiles. Tomatoes were harvested weekly for five weeks from four treatments that differed in system coupling (coupled systems share a recirculating water loop; decoupled systems separate fish and plant water loops) and in light exposure. Three independent systems were used per treatment. Instrumental measurements showed occasional effects of system design on color and firmness, but harvest week had a stronger and more consistent influence. Light–decoupled systems produced firmer fruit in later weeks, although trained panelists did not consistently detect corresponding sensory differences. No treatment differences were observed for any sensory attribute within individual harvest weeks. Volatile analysis using an electronic-nose sensor array—an instrument that detects patterns of volatile compounds—showed substantial overlap among treatments, aligning with sensory findings. In contrast, several sensory attributes, especially green aroma, changed markedly across harvest weeks. Overall, seasonal shifts associated with harvest timing had a greater impact on tomato quality than aquaponic system configuration. These results suggest that, for producers, optimization of harvest management may yield larger sensory benefits than adjustments to system design.

Title: "Check it again": The cultural politics of mentoring in an engineering lab at a research university

Primary Author: Jacob Kelley

Additional Authors:

Mentor: Jonathan Taylor

Department/Program: Educational FLT

College: College of Education

Abstract: Mentoring is often assumed to be an essential and guiding force in higher education. Yet, in practice, mentoring is rarely a straightforward or equitable process. Mentoring takes many forms, including structured programs with formalized guidance, informal relationships that develop organically, and hierarchical systems where access to support is unevenly distributed. Some students benefit from engaged mentors who actively foster their development, while others must navigate a landscape where guidance is inconsistent, transactional, or absent. The expectations around mentoring are often shaped by power dynamics, disciplinary norms, and institutional cultures that privilege certain forms of expertise over others. This ethnographic study aimed to understand the ways in which mentoring is enacted, experienced, and evaluated in an engineering lab at a research university. Drawing on 20 weeks of fieldwork, it situated mentoring within the lived realities of the lab using participant observation and semi-structured interviews. Through an ethnographic lens, it interrogates the unspoken structures that govern mentoring cultures in university research environments. Mentoring is often framed as a necessary and positive force, but it remains deeply uneven. The findings, then, highlight the complexities of mentoring as a site of power, resistance, and adaptation. By centering the everyday practices of lab members, this ethnographic study calls attention to how mentoring is both enabled and constrained by cultural politics within academic spaces. It contributes to ongoing conversations about graduate education by demonstrating that mentoring cannot be assumed to occur naturally and must instead be cultivated with intentionality, care, and equity. Future work could explore mentoring across diverse disciplinary and institutional settings to better understand how structures and cultures might be reshaped to ensure that all students have meaningful access to knowledge and guidance.

Title: A late Cretaceous paleo fire record and its implications for fire regime evolution

Primary Author: Jacob Welch

Additional Authors: Richard Vachula;

Mentor: Thomas Cullen

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Charcoal in sediment provides a proxy for fire regimes in ecosystems. Most of these studies focus on recent geological periods with few applications in deeper-time contexts, and few modern comparisons exist using non-boreal plants. We apply morphometric approaches to charcoal analysis on cores containing Cretaceous sediments, allowing us to test the method in deep-time samples. We compared observed morphotypes in the Cretaceous samples with those of the modern burns, and assessed for potential impacts of preservational biases. Results appear consistent with modern data, suggesting the preserved patterns are not heavily biased by taphonomic processes. Cretaceous sediments preserve angiosperm-associated L:W values of 1.46-2.2, Rectangularity (R) values of 0.85-0.9, and Feret Diameter (FD) values of 102-296 through a 158'-202' core interval, followed by a spike in L:W values ranging from 2-4.5, R values averaging around 1, and FD values ranging from 300-800, signifying gymnosperms and ferns across interval 205'-297'. This is followed by a shift from interval 315'-522' with L:W values between 1.4-2, R values between 0.85-0.94, and FD values ranging from 300-110, consistent with angiosperms. This angiosperm to gymnosperm/fern to angiosperm fuel source shift suggests a more complex picture of angiosperm diversification than has been hypothesized for the Late Cretaceous. We also identified high A:P values (15-67, associated with low intensity burns) found in the 205'-297' interval, contrasted with low A:P values (13-46 and 16-35, associated with high intensity burns) in the 158'-202' and 315'-522' intervals respectively, indicative of less intense wildfires in gymnosperm-dominated vs. angiosperm dominated intervals. Modern baseline data allowed us to determine fuel source composition and effects of preservation on charcoal. These highlight the utility of paleofire methods in deep-time contexts and suggest untapped potential for future paleoenvironmental studies.

Title: Ankle-joint power and AFO deflection: implications for physiologically relevant fatigue testing conditions

Primary Author: Jacquelyn Brokamp

Additional Authors: Michael Zabala;Ivan Nail Ulloa;Ryan Pollard;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Ankle-foot orthoses (AFOs) are commonly prescribed to improve gait in individuals with neuromuscular and musculoskeletal impairments. However, no standardized protocols exist to characterize their mechanical properties, including fatigue life. Although angular deflection has been identified as a key boundary condition for fatigue testing, the biomechanical factors governing AFO deformation remain largely unknown. This study aimed to examine the relationship between ankle-joint power, commonly altered in gait-impaired individuals, and AFO angular deflection during walking and other activities of daily living. Nine healthy adults performed walking trials with and without a rigid, custom-fit, 3D-printed AFO, as well as AFO-assisted sit-to-stand, stand-to-sit, and stair-ascent tasks. Kinematic and kinetic data were collected to compute ankle-joint power and AFO–ankle complex angles during each task. Discrete power and angle events were extracted to assess task-specific power–deflection relationships. The results showed a significant reduction in ankle-joint power generation and maximum plantarflexion during walking. Characterization of the AFO–ankle complex revealed that maximum plantarflexion occurred during loading response rather than at toe-off. No relationship was observed between maximum plantarflexion during loading response and peak power absorption during this phase. In contrast, greater peak power generation during push-off was associated with greater plantarflexion deflection at toe-off. Across activities, walking produced the greatest AFO deformation, indicating that gait imposes the highest mechanical demands and provides a conservative, physiologically relevant basis for fatigue testing. Together, these findings highlight the coupling between ankle-joint power and AFO deformation and support the use of gait-informed loading conditions when defining fatigue testing criteria.

Title: Evaluating the Role of Through-Protein Electron Transfer in Mechanisms of KatG Catalysis, Including Isoniazid Activation

Primary Author: Jada Conner

Additional Authors: Douglas Goodwin;

Mentor: Douglas Goodwin

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: The enzyme KatG is a heme-dependent protein that catalyzes the decomposition of peroxide via multiple mechanisms. The distribution of this enzyme is especially prominent among pathogenic bacteria and fungi. Additionally, the *M. tuberculosis* KatG enzyme activates the prodrug isoniazid (INH) by degrading H₂O₂ via a through-protein electron transfer. A central feature of KatG mechanisms (catalase activity, peroxidase activity, INH activation, enzyme inactivation, etc.) is through-protein electron transfer. Although, KatG mutations are a major contributor to INH resistance, the role of the electron transfer mechanism in this process remains poorly explored. A critical component governing through-protein electron transfer is an “arginine switch” at residue 418, along with oxidizable amino acids such as tryptophan that facilitate the actual electron-transfer steps. To investigate the interplay of Arg 418 and prominent Trp residues in KatG radical transfer processes, we used site-directed mutagenesis to generate KatG variants that replaced Arg 418 with an uncharged side chain (i.e., R418N KatG). Likewise, key Trp residues have been replaced with non-oxidizable Phe (i.e., W91F, W412F, and W321F KatG). Results generated thus far indicate that replacement of the so-called proximal tryptophan (W321F) significantly diminishes KatG’s ability to sustain peroxide decomposition. This effect is substantially amplified when the arginine switch is also substituted (i.e., W321F/R418N). This underscores the cooperative role of the switch and Trp residues in tryptophan-mediated electron transfer through the KatG protein. Ongoing studies involving generation double variants (W91F/R418N and W321F/R418N) aim to further define the electron transfer mechanism and its role in INH activation on going.

Title: Pine straw as an inoculum reserve: Implications for Brown Spot Needle Blight management in loblolly pine

Primary Author: Jaden King

Additional Authors:

Mentor: Lori Eckhardt

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Loblolly pine (<<Pinus taeda>>) is an essential tree species for the timber industry in the southeastern United States. In the past decade, impacts from <<Lecanosticta acicola>> causing Brown Spot Needle Blight have been increasing on all ages of loblolly pine. Disease spread is well documented for living needles, with conidia spreading locally and ascospores spreading long distances. Still, little is known about how fallen needles spread disease or for how long disease persists in the needles once removed from the tree. The objective of this study was to determine how long fallen needles harbour disease. Understanding how fallen needles contribute to infection is essential for better management practices, as some needles fall to the ground and others get stuck in the canopy, close to living foliage. In this study, infected needles were removed from living trees in November 2023 and March 2024, and the needles were monitored for 1 year after removal. Monitoring ended after 1 year due to annual needlefall, which adds fresh fallen needles. Each week, needles were selected and placed in sporulation chambers to identify what sporulates. Microbes recovered include <<L. acicola>>, <<Pestalotiopsis>>, <<Diplodia>>, <<Hendersonia>>, <<Coleosporium>>, <<Lophodermium>>, <<Alternaria>>, and <<Trichoderma>>. All but <<Coleosporium>> and <<Lophodermium>> were recovered at the 1-year mark. These findings confirmed fallen needles can still sporulate disease 1 year after removal, showing that pine litter needs to be managed in addition to the trees growing in the stand. Future work will focus on determining how far disease spreads from fallen needles, including both needles that get stuck and needles that fall to the ground. This is important for stand establishment because younger trees are more susceptible to disease due to limited defense and are closer to the fallen needles on the ground.

Title: A next generation broadly protective influenza vaccine induces cross-reactive antibodies against a panel of antigenically diverse influenza A strains in an immune imprinted porcine model

Primary Author: James North

Additional Authors: Constantinos Kyriakis;Dimitrios Sakkas;Peter James Neasham;

Mentor: Constantinos Kyriakis

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Influenza A viruses (IAV) are important respiratory pathogen in humans, causing seasonal epidemics and occasional pandemics. Annual vaccination serves as the primary prophylactic measure, however traditional IAV vaccines have several shortcomings. They only achieve efficacy rates between 40-60%, while years in which failures during strain selection or vaccine production occur have been as low as 17%. The current method to select strains is based on immunizing naïve ferrets with candidate vaccine strains and using their antibody responses to choose the best match. While this is an important step, most of the human population is exposed to influenza by the age of two. An individual's first exposure to influenza has been shown to impart a lasting influence over future exposures depending on the strains/subtypes involved, questioning how well naïve ferrets model human responses. Our lab has previously demonstrated that Centi-Flu, a novel universal IAV vaccine platform, is immunogenic in naïve swine, another valuable model to study influenza pathogenesis and vaccine candidates. To better understand how this vaccine would perform in the general population it is necessary to test it in an immunologically experienced model. Five groups of swine were enlisted in this study: 3 groups with pre-existing immunity and 2 groups which were naïve. All pre-immune groups and one naïve group were given the Centi-Flu vaccine adjuvanted with ISA-201 (W/O/W emulsion) in a prime-boost regimen, while the final naïve group received a seasonal IAV vaccine. In animals with prior immunity, Centi-Flu induced significant boosting of existing antibody titers, as well as high titers against a broad range of viruses. In contrast the naïve group receiving Centi-Flu or the seasonal vaccine did not reach protective antibody levels. These results highlight the need for preliminary testing of novel universal vaccine candidates in pre-immune models, as well as during seasonal vaccine strain selection.

Title: Annual mapping of forest canopy height in Alabama using spaceborne lidar from 2015 to 2024

Primary Author: Janaki Sandamali Kuda Udage

Additional Authors: Lana Narine;

Mentor: Lana Narine

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Canopy height (CH) is a fundamental forest inventory attribute and is crucial for understanding growth trajectories, recovery, and resilience. However, spatially explicit characterization of changes in CH remains limited due to the scarcity of three-dimensional observations across space and time. With the availability of data from two spaceborne light detection and ranging (lidar) missions, the Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) and Global Ecosystem Dynamics Investigation (GEDI), there are new opportunities to derive CH measurements with improved geographical coverage and sampling density. The primary objective of this study is to evaluate an Earth observation (EO)-based framework that integrates spaceborne lidar data to produce consistent, annual CH maps over a decade. We developed a high-performance computing (HPC) framework that jointly leverages ICESat-2's Land and Vegetation Height (ATL08) and GEDI's level 2A (L2A) data with multispectral, synthetic aperture radar (SAR) (e.g., Sentinel-1/2, Landsat-8/9, ALOS PALSAR) and ancillary predictors to produce 30 m statewide CH maps from 2015 to 2024 by using the Extreme Gradient Boosting (XGBoost) machine learning method. We used reference airborne lidar-derived CH estimates from three National Ecological Observatory Network (NEON) sites in Alabama: Talladega National Forest (TALL), Dead Lake (DELA), and Lenoir Landing (LENO), to evaluate the time-series CH maps. The results indicated good correlations, with Pearson correlation coefficients ranging from 0.66 to 0.74, and root mean squared errors (RMSEs) varying between 4.27 m and 4.94 m. The generated CH products, based on a spatially comprehensive data-driven workflow, demonstrate the potential of deriving consistent CH information across time and space with open-access EO data. Additionally, these CH maps form a critical dataset for applications such as biodiversity and aboveground biomass modeling.

Title: Measures of parent child coregulation

Primary Author: Janishi Hightower

Additional Authors:

Mentor: Jill Salisbury-Glennon

Department/Program: Educational FLT

College: College of Education

Abstract: Parent–child co-regulation is a dynamic, bidirectional process through which caregivers and children mutually influence one another’s emotional, behavioral, and physiological states. Optimizing co-regulation is vital for the development of secure attachment, which impacts children’s later socio-emotional development, executive functioning, and academic success. Although co-regulation has been widely studied, existing research primarily focuses on brief laboratory interactions using mother–child samples. This methodological and relational focus may underestimate variability in co-regulation and limit understanding of how the process unfolds across time and diverse family structures. This presentation reviews research on parent–child co-regulation to examine traditional measurement approaches and identify methodological gaps. Relevant studies were identified using PubMed and ScienceDirect with search terms such as co-regulation, synchrony, and parent–child interaction. Studies examining behavioral and physiological indicators of co-regulation in early childhood were considered. Co-regulation is most often assessed using brief laboratory observations, and is frequently combined with physiological indicators such as cardiac vagal regulation and neural synchrony. While these measures provide insight into momentary regulatory processes, they primarily capture cross-sectional snapshots and may fail to reflect how co-regulation fluctuates across everyday contexts. Fathers and nontraditional family structures also remain underrepresented. To complement laboratory approaches, future research should incorporate repeated observations, naturalistic methods, and more diverse family samples to better capture the dynamic nature of co-regulation as it occurs in daily life.

Title: Hunting Hatchlings: Estimating the Prey Preferences of Cannibalistic Lizards (*Anolis sagrei*)

Primary Author: Jaycee Wisdom

Additional Authors: Anthony Gilbert; Sydney Wayne; John Rodgers; Matthew Smith;

Mentor: Daniel Warner

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Most predatory animals hunt individuals that are of different species, but cannibalism is commonly observed throughout the animal kingdom. For example, male lions will eat cubs fathered by rival males to increase their own reproductive success, but in other cases, cannibalism occurs when food is scarce. In reptiles, cannibalism has been recorded in approximately 50 species. In the brown anole lizard (*Anolis sagrei*), cannibalism has been observed numerous times both in captivity and the wild, mostly involving adults eating juveniles. Field studies support the idea that hatchling survival drops when adult density is high, raising questions about whether *A. sagrei* prefers to eat hatchlings or if they can distinguish hatchlings from other prey while foraging. In this study, we evaluated the feeding preferences of adult brown anoles, hypothesizing that brown anoles exhibit cannibalism because they are unable to discriminate between moving prey items. Since brown anoles are sit-and-wait predators, we developed a moving prey assay that standardized the speed at which different prey items were presented to each lizard. Preliminary observations suggest brown anoles do not discriminate between insect or hatchling prey items, suggesting the frequency of cannibalistic interactions is more common in natural populations of small-bodied reptiles.

Title: Carbon pools dynamics of dry prairies with different prescribed-fire intervals in the southeastern U.S.

Primary Author: Jayro Chevez Sahona

Additional Authors: Timothy Shearman; Tamara Milton; Heather Alexander;

Mentor: Heather Alexander

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Low-intensity surface fires maintain and restore dry prairies in the southeastern U.S., yet carbon (C) responses in belowground pools and the ground layer remain insufficiently quantified. We addressed two questions: (a) How belowground C pools differ among recently restored prairies, remnant prairies, and closed-canopy forests; and (b) How ground-layer vegetation C (GLV-C) varies with prescribed-fire interval (annual vs 4-year) in restored and remnant prairies. We quantified mineral soil C (0–30 cm), fine-root C (<2 mm), coarse-root C (>2 mm), and GLV-C across sites in the Interior Plateau and Southeastern Plains. Remnant prairies contained the greatest belowground C, driven by mineral soil (mean $\approx 204 \text{ Mg C ha}^{-1}$) and higher fine-root C ($\approx 5.6 \text{ Mg C ha}^{-1}$), exceeding both closed-canopy forests (mineral soil $\approx 64 \text{ Mg C ha}^{-1}$; fine roots $\approx 2.1 \text{ Mg C ha}^{-1}$) and recently restored/dry prairies (mineral soil $\approx 42 \text{ Mg C ha}^{-1}$; fine roots $\approx 2.0 \text{ Mg C ha}^{-1}$). Belowground C in remnant prairies was especially high in the Southeastern Plains relative to the Interior Plateau. Ground-layer C varied with fire history and composition: annually burned dry prairies averaged $\approx 2.7 \text{ Mg C ha}^{-1}$ in GLV, while 4-year interval restored prairie plots averaged $\approx 2.8 \text{ Mg C ha}^{-1}$, with graminoids contributing most of the GLV-C. Together, results indicate that remnant prairies can function as substantial belowground C reservoirs, while prescribed-fire interval influences the distribution of fast-cycling ground-layer C during restoration.

Title: From Clinic to Comfort: Designing Emotionally Supportive Hospital Waiting Rooms

Primary Author: Jenna Nicholls

Additional Authors: Ellie Rea;

Mentor: Georges Fares

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Hospitals increasingly adopt hospitality inspired design strategies to reduce stress and enhance patient experience. While prior research has focused primarily on patient rooms, waiting rooms remain underexplored despite serving as the first point of contact for patients and caregivers. This study experimentally examined how seating configurations and material selections influence emotional responses and perceived quality of care in healthcare waiting environments. Thirty undergraduate students ages 18 to 24 were recruited from a university population to ensure a developmentally consistent cohort familiar with immersive technologies. Using a within subjects experimental design, participants experienced three distinct waiting room variations in immersive virtual reality. The environments differed in social seating configuration and hospitality-inspired material expression while maintaining comparable spatial dimensions. Following each VR exposure, participants completed validated self-report measures assessing emotional response and perceived quality of care, including the Positive and Negative Affect Schedule for affective states and an adapted healthcare service quality scale to evaluate care perception. Results indicated statistically significant differences across conditions. Waiting rooms featuring clustered, socially oriented seating and warmer material palettes were associated with higher positive affect and significantly higher perceived quality of care compared to linear, less socially supportive configurations. Findings suggest that spatial layout and material expression meaningfully shape emotional appraisal and expectations of care. By addressing gaps in waiting room research, this work provides evidence-informed guidance for designing emotionally supportive, guest-centered healthcare waiting environments.

Title: Invisible stressors, visible harm: financial strain, maternal depression, and physical assault in single-mother households.

Primary Author: Jennifer Agyemang Duah

Additional Authors: Silvia L. Vilches;

Mentor: Silvia L. Vilches

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Physical assault of children is a serious public health concern with lasting consequences for child development and family well-being. Single-mother households may be especially vulnerable due to the intersection of financial stress and maternal mental health challenges. However, less is known about how these factors operate together to influence risk for physical assault. This study addresses this gap by examining whether maternal depression moderates the association between financial strain and physical assault of the child among single mothers. Data were drawn from the Year 5 wave of the Future of Families and Child Wellbeing Study, a longitudinal birth cohort of children born in large U.S. cities. The analytic sample included single mothers assessed when focal children were approximately five years old, with a mean maternal age of 30.43. A cross-sectional design was used to test whether maternal depression moderated the association between financial strain and physical assault of the child. Results revealed a significant interaction between financial strain and maternal depression. Financial strain was positively associated with physical assault across levels of maternal depression; however, this association was strongest when maternal depression was low and weakened as maternal depression increased. These findings indicate that maternal depression conditions how financial strain translates into physically aggressive parenting behaviors. This study points out the importance of addressing both economic hardship and maternal mental health in efforts to prevent child maltreatment in single-mother households. Findings have implications for policy and intervention strategies that integrate financial support with mental health services to promote family stability and reduce physical assault risk.

Title: Common pollen floral resources of the southeastern United States fed in vitro to western honey bee larvae

Primary Author: Jennifer Standley

Additional Authors: Laura Huber;Kiranmayee Bhimavarapu;Anthony Abbate;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: In vitro rearing western honey bee (*Apis mellifera*) larvae is a powerful method used to investigate how various agents, such as pesticides and hormones, affect their development. In this study, pollen commonly found in the southeastern United States was fed to developing larvae. Currently, there are no standardized methods that incorporate pollen supplementation into the protocol. Therefore, this study represents a novel approach toward developing a modified and standardized method, including the effects of various floral diets. A diet consisting of 2 mg pollen from *Lagerstroemia indica* (crape-myrtle), *Melilotus/Trifolium* (clover), *Magnolia* spp., *Triadica sebifera* (tallow), or a polyfloral blend of the four, was fed to larvae (n=1,272) collected from 11 honey bee colonies. Developmental time and survival to pupation and emergence were measured, including final mass at emergence. Following the lowest AIC, a generalized linear mixed model and pairwise comparison was used for each analyses. There were no significant differences for developmental times. Additionally, the probability of survival to both pupation and emergence respectively were: no-pollen (95%; 0.91–0.97), (86%; 0.81–0.90); crape myrtle (90%; 0.85–0.94), (65%; 0.58–0.71); clover (86%; 0.79–0.90), (61%; 0.55–0.68); polyfloral (79%; 0.72–0.85), (55%; 0.48–0.61); tallow (75%; 0.67–0.81), (56%; 0.49–0.62); and magnolia (71%; 0.62–0.78), (44%; 0.37–0.51); (probability; LCL–UCL 95%). For mass at emergence, the polyfloral produced significantly heavier individuals ($\beta=3.01\pm7.13$ 95% C.L.; $p=0.05$) than magnolia. Overall, our findings indicate the pollen sources investigated in comparison to the no-pollen control had similar influence on survival to pupation, significant negative effect to emergence, and minimal differences on mass at emergence. Furthermore, this study will contribute to the standardization of pollen feeding for in vitro rearing honey bee larvae.

Title: What college students think is contributing to the rise in anxiety and depression among young people

Primary Author: Jessica Bailes

Additional Authors: Conner Johnston;Brooks Triplett;Mary Recine;Kennedi Proffitt;Claire Diaz;Diana Samek;

Mentor: Diana Samek

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Depressive, anxiety, and other internalizing symptoms have been steadily increasing among adolescents and young adults since 2011. The purpose of this study was to discover what a diverse sample of young adults in the American Southeast think is contributing to the increasing mental health crisis. In 2025, 141 former first-year AU students (81.6% students of color) completed a survey. An open-ended question asked them to share what they thought was contributing to the increase in mental health symptoms among young people. Responses were coded using thematic analysis. Each case was then coded according to the co-written code list/book, which was generated after reading through all 106 responses provided (75.2% of respondents surveyed). Cases were then dyad coded. Agreement of the 81 possible codes for each case ranged from 98.9% to 100.0% ($M = 98.9\%$). The most frequently endorsed code group was in relation to social media ($n=58$ or 54.7% of responses), with endorsements of 12 social media sub-codes. The most frequent were specific to social comparison (e.g., feeling excluded, not as successful as others; $n=34$), that social media promoted unrealistic standards ($n=18$), that there are less in-person interactions (e.g., deep connections; $n=8$), and that people are meaner online (hate speech, bullying; $n=6$). Another frequently endorsed category was related to stress ($n=56$ or 52.8% of responses), with the most frequent sub-codes attributing this to the rise in economic and financial pressure (e.g., widening income gap, not being able to afford a home after college; $n=29$), uncertainty (e.g., worrying and feeling helpless about the future; $n=13$) and academic stress ($n=16$). Results support efforts to promote mental health among young people by encouraging them to monitor negative emotions while on social media, limit use/take breaks as needed, psychoeducation on healthy ways to cope with stress, as well as policy efforts to address affordable housing and economic uncertainty.

Title: AAV Treatment in GM1 Gangliosidosis

Primary Author: Jessica Stanhouse

Additional Authors:

Mentor: Amanda Gross

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: GM1 gangliosidosis is a rare, genetic disorder caused by a mutation in the gene that encodes lysosomal β -galactosidase (Bgal). Though primarily a neurodegenerative disease, the whole body is affected. The laboratory at the Scott-Ritchey Center uses adeno-associated viral (AAV) gene therapies to deliver a correct copy of the gene throughout the body, potentially treating GM1 with one injection. AAV therapy dosing was explored by examining various peripheral tissues and brain regions of cat models. By working on determining the ratio of SV40 primer (part of AAV treatment) to Albumin primer (monitoring general cell function), comparisons can be made on how the treatment reached different parts of the AAV stunner-treated versus qPCR-treated cats. Conversions can then be determined between the cats that were dosed with qPCR titers (which were less consistent results but at a lower dosage) and stunner titers (more consistent but higher dosage). The results showed that to maintain consistency between dosing, the qPCR titers should be administered twice as much as the stunner method dosing. Ultimately, to effectively treat GM1, it must be understood how to appropriately dose the AAV treatment.

Title: PF-07258669 is a novel potent pharmacoperone for intracellularly retained melanocortin-4 receptor mutants

Primary Author: Jiahui Duan

Additional Authors:

Mentor: Ya-Xiong Tao

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: The melanocortin-4 receptor (MC4R) is a G protein-coupled receptor primarily expressed in the hypothalamus, particularly in the paraventricular nucleus. MC4R mutations represent the most common monogenic cause of obesity in humans. Pharmacoperones are small molecules that bind to misfolded MC4R within the endoplasmic reticulum, stabilizing its structure and promoting correct folding and trafficking to the plasma membrane. The small molecule MC4R antagonist PF-07258669 has been tested in animal models, where it stimulates appetite and promotes body weight gain. In this study, we examined whether PF-07258669 can function as a pharmacoperone, facilitating proper folding and cell surface trafficking of misfolded mutant MC4Rs, hence restoring functions of the mutant receptors. Human embryonic kidney (HEK) 293T cells were transiently transfected with wild-type (WT) or mutant human MC4R constructs. Cells were treated with various concentrations of PF-07258669 or with DMSO as a negative control for 24 h at 37 °C. On the day of the experiment, cells were stimulated with 10⁻⁶ M agonist setmelanotide for 1 h at 37 °C. Intracellular cAMP was extracted. We first examined the effect of PF-07258669 and 2 identified MC4R pharmacoperones on five MC4R mutants that had not previously been tested for pharmacoperone activity. Treatment with 10⁻⁷ M PF-07258669 increased cAMP levels of N97D, I125K, Del170, C172R, and P299L. In comparison, 10⁻⁵ M ML00253764 increased cAMP levels of I125K, Del170, C172R, and P299L, whereas 10⁻⁶ M Ipsen 5i increased cAMP levels of Del170, C172R, and P299L. We next examined the effect of 10⁻⁷ M PF-07258669 on 11 additional MC4R mutants that had previously been tested for pharmacoperone activity. 10⁻⁷ M PF-07258669 increased cAMP levels of N62S, P78L, C84R, G98R, R165W, W174C, P260Q, and C271Y, whereas S58C, I69R, and Y157S did not respond. Increased cAMP accumulation was observed at 10⁻⁹ M PF-07258669 for C84R, with maximal responses observed between 10⁻⁸ M and 10⁻⁶ M for P78L, Del170, P260Q, and P299L. These results suggest that PF-07258669 acts as an effective pharmacoperone for MC4R.

Title: Effects of cyclosporine and dexamethasone on cytokine expression in canine whole blood

Primary Author: Jidapa Tosuwan

Additional Authors: Crisanta Cruz-Espindola; Alex Jenkins; Kamoltip Thungrat

Mentor: Kamoltip Thungrat

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Immune-mediated disease in dogs involves Th1/Th2 imbalance, with IL-2-stimulated Th1 activity producing TNF- α and IFN- γ , leading to tissue destruction. Cyclosporin (CsA), in addition to glucocorticoids, is widely used to suppress these cytokines; however, optimal CsA dosing remains unclear due to variable responses. Defining the dose-dependent immunomodulation of CsA, alone and in combination with glucocorticoids, is essential to refine therapy. We hypothesized that CsA and dexamethasone produce dose-dependent suppression of Th1-associated cytokines, with greater inhibition for combination treatment. The objective was to identify drug concentrations associated with cytokine modulation in canine lymphocytes. Heparinized blood from commercially sourced healthy dogs was used; no live animals were enrolled. This ex vivo experimental study evaluated Th1- (IL-2, TNF- α , and IFN- γ) and Th2-related (IL-4) cytokine mRNA expression in canine whole blood treated with CsA (200–2000 ng/mL), dexamethasone (0.025–25 μ M), or combinations. After one hour of drug exposure, T-lymphocytes were stimulated with PMA/ionomycin for 5 hours. Cytokine mRNA was quantified by RT-qPCR using the $2^{-\Delta\Delta C_p}$ method, normalized to GAPDH and B2M. CsA at 1000 ng/mL significantly suppressed IL-2 (0.02-fold) and IFN- γ (0.01-fold) ($p < 0.0001$). Dexamethasone at 2.5 μ M suppressed all tested cytokines. The combination of CsA (1000 ng/mL) and dexamethasone (2.5 μ M) increased IL-4 expression ($p < 0.0001$). CsA and dexamethasone demonstrated dose-dependent cytokine modulation, and the combination increased IL-4, indicating Th2 rebounding that may rebalance Th1-dominant immunity. These findings support a combination approach rather than high-dose monotherapy in canine IMHA.

Title: Beyond Studying Hard: Factors That Influence Student Focus and Learning Effectiveness

Primary Author: Jihyun Paik

Additional Authors: Minseo Kang;

Mentor: Myounggi Chon

Department/Program: Nursing

College: College of Nursing

Abstract: A student's performance is influenced by a wide range of cognitive, behavioral, and environmental factors. With the increasing integration of technology and evolving study methods among college students, it is important to examine how specific lifestyle and academic practices contribute to students' focus levels and overall academic success. This study aims to investigate the relationship between five potential focus-enhancing factors, including the use of artificial intelligence (AI) study tools, study format (individual versus group studying), levels of physical activity, characteristics of the studying environment, and the perceived urgency of academic deadlines. Using a cross-sectional Qualtrics survey, Auburn University students will be asked to report their academic habits, perceived performance levels using the Academic Performance Scale (APS), and academic outcomes such as self-reported grade point average (GPA) or course performance. Additional measures will assess the frequency and purpose of AI usage in academic tasks, study collaboration patterns, engagement in physical exercise, preferred study settings, and the pressure from deadlines. Statistical analyses will be done to find relationships between these factors and student performance. The findings of this study aim to provide insight into which academic and lifestyle strategies may support improved concentration and learning effectiveness among Auburn University students. Understanding these relationships may help students adopt more effective study behaviors and inform educators and institutions in developing supportive learning environments in an increasingly technology-driven academic world.

Title: Revolutionizing veterinary oncology: A nanobody-based approach to immune checkpoint therapy

Primary Author: Jillian Henderson

Additional Authors: Maninder Sandey; Bruce F. Smith; Payal Agarwal; Damien Ruiz; Himanshi LNU; Alana Kramer; Jonathan Marable;

Mentor: Maninder Sandey

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Cancer is the leading cause of death in geriatric dogs (>10 years), yet current treatment options provide limited survival benefits and are frequently associated with significant toxicity. Tumor-mediated suppression of T-cell activity through the PD1/PD-L1 immune checkpoint is a major barrier to effective anticancer immunity. Tumors frequently exploit this critical immune checkpoint to evade immune surveillance through PD-L1 overexpression. This project aimed to develop a nanobody-based immunotherapy that restores T-cell function by blocking the PD-1/PD-L1 signaling pathway, thereby enhancing tumor clearance. We previously identified anti-PD-1 and anti-PD-L1 nanobodies that bind to canine PD-1 and canine PD-L1. With this, we selected three cross-reactive anti-PD-1 nanobodies and one cross-reactive anti-PD-L1 nanobody that recognizes both canine and murine targets. These nanobodies were cloned into the SPB-015 vector and used to generate Expi293F-derived stable cell lines for expression and purification by affinity chromatography. ELISA and flow cytometry confirmed specific, high-affinity binding to both canine and mouse PD-1 and PD-L1. Functional assays demonstrated inhibition of the PD-1 and PD-L1 interaction, indicating effective checkpoint blockade. These findings support advancements to in vivo efficacy studies in murine and tumor models and highlight the potential of nanobody-based PD-1/PD-L1 inhibitors for translation to canine oncology.

Title: Evaluating the impact of dual orexin receptor agonists on behavioral and cognitive symptoms in narcoleptic orexin knock-out (OXKO) mice

Primary Author: Jillian Manville

Additional Authors: Daniel Kroeger;Eva Ortiz-Feder;Menaka Marasinghe Mudiyanseilage Mohottala;Natasha Wendy Grabau;Tara Flynn;

Mentor: Daniel Kroeger

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Narcolepsy is a chronic sleep disorder which is marked by low levels of orexin, a neuropeptide released in the brain during wakefulness. The primary symptoms of narcolepsy are excessive daytime sleepiness, sleep paralysis, hallucinations, abnormal REM sleep, and cataplexy (a sudden loss of muscle tone). However, there are also secondary symptoms in Narcolepsy patients, which include memory impairment, anxiety, and depression. Importantly, the two receptors for the orexin peptide (OX1R and OX2R) stay intact in Narcolepsy and can be artificially activated by orexin receptor agonists. For the current study, we assessed two novel orexin receptor agonists and their therapeutic potential in treating the secondary symptoms, using a mouse model of Narcolepsy. Specifically, we used orexin knockout (OXKO) mice, which lack the gene to produce the orexin neuropeptide. To assess the efficacy of our agonists, we employed three behavioral tests: The Morris water maze was used to test spatial memory. The open field test was used to assess anxiety-like behaviors, while the tail suspension test was employed to measure depression-like symptoms. One hour before each test was performed, control mice and OXKO mice were treated with either a vehicle (no compound), a OX2R agonist or a dual receptor agonist i.e. an agonist designed to activate both orexin receptors (OX1/2R). The results of this experiment suggest that the dual OX1/2R agonist improved spatial memory and depression-like behavior more than the OX2R agonist, while both improved anxiety-like behavior equally.

Title: Molecular Genetics and Pharmacogenomic Opportunities in Frontotemporal Dementia

Primary Author: John Beall

Additional Authors: Muralikrishnan Dhanasekaran;Suhrud Pathak;Keyi Liu;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Frontotemporal dementia (FTD) encompasses a group of early-onset, progressive neurodegenerative disorders characterized by degeneration of the frontal and temporal lobes. The disease is driven by the accumulation of misfolded proteins, most commonly tau or TDP-43, resulting in marked behavioral, personality, and language impairments. FTD includes several clinical and pathological subtypes with distinct molecular mechanisms, making it a compelling candidate for personalized pharmacogenomic approaches. Disease onset typically occurs between 45 and 64 years of age, though cases have been reported across a broader age range. Pathogenic variants in MAPT, GRN, and C9orf72 account for a significant proportion of familial FTD cases. Mutations in MAPT and GRN disrupt tau and progranulin pathways and are associated with FTD as well as related tauopathies, including primary progressive aphasia, progressive supranuclear palsy, and corticobasal degeneration. Currently, no FDA-approved disease-modifying therapies exist for FTD, and available treatments are limited to symptomatic management, highlighting a substantial unmet clinical need. Latozinemab has recently emerged as a targeted pharmacogenomic therapy for GRN-associated FTD. Loss-of-function variants in GRN reduce progranulin levels, compromising neuronal survival and lysosomal function. Latozinemab increases circulating progranulin by inhibiting its degradation; however, its phase 3 clinical trial was discontinued due to safety and efficacy concerns. This outcome underscores both the potential and current limitations of genotype-guided therapies in FTD. The aim of this study is to synthesize existing literature on the genetics and pharmacogenomics of FTD to identify knowledge gaps and inform future research priorities.

Title: LH and FSH Concentrations in AAV-GnRH Treated Offspring Kittens

Primary Author: John DeMent

Additional Authors: Arthur Zimmerman;

Mentor: Aime Johnson

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Scientists are exploring alternatives to traditional surgical sterilization to address the growing feral and free-roaming cat population, as spaying and neutering can be costly, invasive, and difficult to implement on a large scale. One proposed alternative involves the use of adeno-associated virus (AAV) vectors that deliver gonadotropin-releasing hormone (GnRH) to induce long-term reproductive suppression. Previous research demonstrated that first-generation AAV-GnRH treatment altered reproductive hormone profiles in treated cats; however, the potential effects of this treatment on subsequent offspring were not established. This study investigated whether AAV-GnRH infection in parent animals results in endocrine disruption in kittens during the perinatal stage. Blood samples were obtained from five kittens born to treated parents, including two male kittens from a treated male and three female kittens from a treated female. Samples from untreated control kittens were also collected for comparison. Serum concentrations of luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were evaluated using enzyme-linked immunosorbent assay (ELISA) to assess hypothalamic-pituitary-gonadal axis function. Blood sampling was performed at multiple time points throughout the perinatal and early postnatal periods to evaluate hormonal secretion patterns over time. The findings showed alterations in hormonal levels and secretion patterns. The primary disruption occurred through modifications in LH secretion patterns rather than changes in the timing of the perinatal phase. LH concentrations in affected kittens returned to prepubertal levels around 8–9 weeks of age, similar to control kittens. During this period, sex-specific differences emerged: impacted female kittens exhibited more regular LH peaks, whereas affected male kittens displayed fewer peaks that were higher in intensity. When considered together, the LH and FSH findings suggest that the observed perinatal hormonal imbalance is likely due to GnRH overstimulation, favoring LH secretion over FSH. Although these results point to potential early endocrine disruption, the small sample size limits definitive conclusions. Additional research is needed to measure GnRH concentrations in kittens, determine possible maternal or paternal transmission pathways, and evaluate long-term effects on reproductive function as well as cognitive and sensory development. If validated, this work could inform the safety and feasibility of AAV-based sterilization strategies as a non-surgical approach to population control.

Title: Microcrystalline cellulose compatibilized polypropylene/high density polyethylene blends: the effect of the mixing temperatures

Primary Author: John Edwards

Additional Authors: Ke Zhan;

Mentor: Yucheng Peng

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The recycling of post-consumer plastics often results in mixed polypropylene (PP) and high-density polyethylene (HDPE) blends, as they have similar densities and chemical structures. However, these two polymers do not mix well at the molecular level, which leads to poor interfacial bonding and weaker mechanical properties. This limits the reuse of recycled materials in high-value applications. A previous study demonstrated that adding microcrystalline cellulose (MCC) and maleic anhydride-grafted polyethylene (MAPE) can significantly improve the mechanical performance of the PP/HDPE blend with HDPE as the minor phase (dispersed). In that study, composites were prepared by directly mixing all the components simultaneously at 200 °C. This study was developed to investigate the effect of mixing temperature on the mechanical performance of the blends. A new composite manufacturing procedure was developed that utilizes the lower melting temperature of HDPE by mixing MCC, MAPA, and HDPE at 150°C first, then mixing with PP at 200 and 250°C. The research hypothesis was that, at a lower mixing temperature, HDPE can wrap around MCC particles, thereby reducing MCC thermal degradation during composite manufacturing at 200 and 250 °C. Reducing thermal degradation of MCC would improve the composite's mechanical performance. Direct mixing of all components for composite manufacturing at 200 and 250 °C were also performed to be used as the control samples. The objective of this study is to research the effect of the mixing temperature on the mechanical properties of the blends. The mechanical behavior of the composites was evaluated through tensile, flexural, and impact testing. The results showed that blends prepared using the newly developed mixing procedure do not significantly alter mechanical properties. The findings from the study provide a clearer understanding of the influence of processing conditions on recycled polymer composite performance.

Title: Defining the sea urchin larval immune response to the Gram positive bacterium, *Paenibacillus glucanolyticus*

Primary Author: John Johnson

Additional Authors: Jake Tatum; Katherine Buckley;

Mentor: Katherine Buckley

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The purple sea urchin (*Strongylocentrotus purpuratus*) provides a unique model system to study immune responses. As invertebrate deuterostomes, sea urchins share important genetic and developmental similarities with vertebrate immune systems. Most sea urchin species include a long-lived, planktonic larval stage. Larvae are transparent and morphologically simple, which enables real-time observations of system-wide immune responses. As filter feeders, the larval gut system is open to the wide variety of marine bacteria present in the environment. As invertebrates, sea urchins lack adaptive immunity and instead rely on an expanded set of innate immune receptors (e.g., Toll-like receptors [TLRs] and Nod-like receptors [NLRs]) to detect these different species of marine bacteria and activate the immune response. In response to specific bacterial species, the larval gut epithelium becomes inflamed, triggering rapid upregulation of the cytokine IL-17 and subsequent immune cell migration. This response has been well-characterized in the context of exposure to several species within the *Vibrio* genus, a diverse, heterotrophic group of Gram-negative bacteria common in marine systems. However, prior to this work, the larval response to Gram positive pathogens remained undefined. Here, we have established the Gram-positive bacterium *Paenibacillus glucanolyticus* as a novel pathogen for sea urchin larvae. This species was isolated from aquaria housing adult sea urchins. Results indicate that the larval cellular immune response to *P. glucanolyticus* mirrors that of *Vibrio* sp. Ongoing work will define how this unique microbial challenge activates immune-related transcripts. This work represents the first characterization of a Gram-positive pathogen for purple sea urchin larvae and extends our understanding of the sea urchin immune response.

Title: The rise of corporate share buybacks: Patterns, sectoral differences, and implications for investment and labor dynamics in the United States.

Primary Author: John Knitter

Additional Authors: Jitka Hilliard;

Mentor: Jitka Hilliard

Department/Program: Finance

College: Harbert College of Business

Abstract: Corporate share repurchases have become a dominant tool for capital distribution to shareholders among U.S. public companies, fundamentally altering the balance between shareholder returns and reinvestment in productive assets. This study analyzes long-term trends in the prevalence and scale of buybacks over recent decades, drawing on firm-level data from WRDS accessed via Jupyter and Python. We examine buybacks across industries and benchmark their growth against key alternative uses of capital: research and development (R&D) expenditures, dividends, capital investments, and employment levels. The findings show that buyback growth has significantly outpaced these other outflows, with repurchases surging well beyond dividends, R&D, and capital expenditures. This pattern is especially pronounced among large-cap firms and in the services sector, where buyback activity accelerated sharply after 2010. Concurrently, worker compensation has lagged behind productivity gains. Collectively, these patterns point to a profound structural shift in U.S. corporate priorities toward financialization. The results enrich ongoing discussions on corporate governance, the sustainability of long-term investment, and the drivers of income inequality in the contemporary economy.

Title: Learning predictive signals from satellite imagery for commodity futures markets

Primary Author: John Lieb

Additional Authors: Sathyanarayanan Aakur;

Mentor: Sathyanarayanan Aakur

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Commodity markets are heavily influenced by physical characteristics such as grade, quality, and origin, yet these factors are rarely used in practice to analyze or forecast market movements. Satellite imagery presents a possible solution by enabling real-time monitoring of the production, distribution, and storage of such commodities. As access to geospatial data has increased, market participants have used this information to monitor for extreme supply line disruptions. However, it is unclear whether satellite imagery encodes systematic information that can be used to consistently predict commodity futures returns. This research aims to determine whether embeddings derived from satellite images can be used to forecast returns on associated agricultural commodities. For a given agricultural region, monthly 10 km x 10 km satellite image tiles from the publicly available Landsat database are passed through a pretrained ResNet50 convolutional neural network to generate embeddings. Principal component analysis reduces these embeddings to lower dimensions, and the resulting components are aligned with the next month's futures returns and evaluated across financial volatility regimes. In a test using satellite imagery from Iowa corn fields and corn futures data, the analysis shows that these components are systematically correlated with futures price movements, with a stronger correlation during high-volatility financial regimes. Tiles with high predictive power are geographically clustered, indicating that distinct physical features in Iowa contain information about corn price movements. This research demonstrates that geospatial data is relevant to futures markets and motivates expansion into additional commodities and regions, including soybeans and wheat in the Midwest and Great Plains, and almonds in California. It also provides a method for including geospatial information in existing quantitative models and risk management strategies.

Title: Evaluating testimony related to proposed legislation on feral cat management in Hawaii

Primary Author: John Pechon

Additional Authors:

Mentor: Christopher Lepczyk

Department/Program: Business Analytics and Info Systems

College: Harbert College of Business

Abstract: Feral cat management in Hawaii has been a point of conflict between stakeholders for decades. Such conflict may be responsible for the difficulty in passing legislation pertaining to cat management in the state. Given the numerous bills proposed to address cat-related issues, our overall goal is to evaluate stakeholder support or objection towards specific policy objectives and their rationale for it. We evaluated how Hawaii residents, agencies, and organizations responded to proposed legislation involving feral cats, domestic cat sterilization, and broader wildlife impacts, with particular focus on trap-neuter-return (TNR) as a policy solution. We accessed the Hawaii State Legislature's public testimony archives from 2018 to 2025, comprising 17 bills, and analyzed the complete testimony record associated with each measure. We categorized testimonies by stakeholder group, position, thematic emphasis, and use of ecological or scientific reasoning. We also examined each bill for its underlying management assumptions. The dataset contains more than 3000 pages of testimony, with substantial engagement from both supporters and opponents. Conservation organizations and state agencies emphasized predation risks to Hawaii's endangered bird species and viewed TNR as inadequate for reducing long-term population pressure. Animal welfare groups and many residents supported TNR based on ethical commitments, community management experience, and skepticism toward lethal control. Private organizations and neutral governmental bodies often provided assessments without taking a clear position. These patterns highlight the divide between evidence-driven ecological arguments and welfare-centered reasoning. The findings offer a view of Hawaii's legislative debate on feral cat policy over time and clarify how scientific evidence, values, and public discourse interact within a vulnerable ecological setting.

Title: Preliminary results from eyeblink conditioning study in undergraduates

Primary Author: John Walker

Additional Authors: Caleb Spink; John Falligant;

Mentor: John Falligant

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Eyeblink conditioning (EBC) is a Pavlovian paradigm with well-mapped neural substrates and tightly controlled experimental parameters, and it has been widely used as a translational model for studying learning processes in both basic and applied research. In delay conditioning paradigms, a conditioned stimulus (CS), a tone, overlaps and co-terminates with an unconditioned stimulus (US), an air puff to the eye. Our study is focusing on how the timing of events during learning influences Pavlovian conditioning. Specifically, it focuses on the relationship between the spacing of learning trials and the delay between a cue (i.e., tone) and its outcome (i.e., air puff). This is referred to as the C/T ratio, which compares the inter-trial spacing (C) to the cue–outcome delay (T). Basic research in non-human models has shown that higher C/T ratios improve learning outcomes (e.g. latency to acquisition, resistance to extinction, timing of conditioned responses, etc.). This critical aspect of Pavlovian learning, however, has been largely overlooked in learning research with humans. We present the results of eyeblink conditioning in Auburn undergraduate students pseudo-randomly assigned to one of three different protocols from literature. These protocols are based on studies conducted by Chess and Green (2008), with a C/T ratio of 41, and two from Frings et al. (2010), with C/T ratios of 69.18 and 36.72, respectively. Preliminary results from this study suggest that the C/T ratio does affect learning outcomes (which will be presented in detail), with smaller C/T ratios being more effective. This is consistent with the findings in basic research. The overall goal of this study is to determine whether larger C/T ratios are associated with more effective Pavlovian learning outcomes in humans. The results of this study of EBC in humans may provide translational insight into additional applications of Pavlovian learning in behavioral interventions.

Title: Application of machine learning to extract flow features in fluid dynamics

Primary Author: Jonathan Goodrich

Additional Authors:

Mentor: Nek Sharan

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Multiple government and private space missions will explore the Moon and Mars in the coming years. An often-unrecognized detail by the public in these missions is the difficulties that arise from Plume Surface Interactions (PSI). The spacecraft creates PSIs, which make the ground unstable and difficult to interact with when taking off, causing unsafe conditions. With the rise of Recurring-Neural Networks (RNN)'s employed in scientific fields, there is a belief that they can be of service in analyzing these craters. The purpose of this research was to study how different RNN's can predict the shapes of craters formed by impact forces. We used Data from NASA's Physics-Focused Ground Tests and two RNN models: A Long Short-Term Memory (LSTM) model and a transformer model. Though researchers believe transformer models to be far superior, we conducted the bulk of the tests on the LSTM model due to computational limitations. We observed three distinct crater shapes: annular, parabolic, and deep parabolic. By changing the hyperparameters of the model, we generated different results over nineteen runs of six crater cases. We changed the number of training cases and test cases over time to assess data convergence. The first run used all six cases as test cases but excluded them from the training cases. This resulted in an average normalized error of 0.159 when predicting crater height, while the last run had an average normalized error of 0.0565. This last run had no test cases, but the model trained on all six of the cases. This implies that to be effective, LSTM models require full datasets, which is not possible in real scenarios, further proving that Transformer models are superior, and may have a future in aerospace applications.

Title: VLF remote sensing of ionosphere perturbations caused by rocket exhaust plasma

Primary Author: Jonathan Gunasekaran

Additional Authors:

Mentor: Hunter Burch

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: With increased interest in commercial space missions, the number of rockets launched over the past few years has increased exponentially. As these rockets travel through the atmosphere, plasma ejected as fuel exhaust may cause localized cavities of modified electron density that could affect communication and navigation systems that rely on atmospheric path-correction factors. Previous work using total electron content (TEC) has shown observable disturbances caused by rocket launches within the higher altitude E/F-regions of the ionosphere. Despite these findings, rocket launches have not yet been characterized within the lower D-region of the ionosphere. This study aims to investigate the effects of exhaust plasma in the D-region using standard VLF (very low frequency) remote sensing techniques, with the primary goal of modeling and classifying rocket launches to better characterize the ionosphere. A small sample set of rocket launch events at nearby sites, such as Cape Canaveral, were identified using publicly available API data. With data collected at the Auburn University VLF receiver, narrowband amplitude and phase data were plotted for select VLF transmitters, so that each sensing path of interest could be analyzed for any unusual VLF disturbances. GOES X-ray flux data were also cross-referenced to isolate any potential rocket launch signatures from solar activity. The narrowband data from each event were then processed across a series of days before and after each launch to search for any evidence of persistent ionization or acoustic gravity waves in the D-region, while also studying possible preconditions and postconditions associated with such events. As the number of space missions continues to increase year after year, further investigations across broader data sets and additional geophysical parameters will be necessary to provide a better picture of the potential ionospheric effects of these rocket launches.

Title: The Fellow Farmer Effect: An argument for interdisciplinarity in practice adoption research

Primary Author: Jordan Smeby

Additional Authors:

Mentor: Michelle Worosz

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Since the 1930s Dust Bowl, agriculturalists, researchers, and Extension have innovated practices to improve the conservation of soil and water. They have developed technologies and vast quantities of data to help better understand the ways that farming practices impact the sustainability of soils. Despite this depth of knowledge, the adoption of these innovations remains remarkably low. The social sciences provide strong support for the effectiveness of peer-to-peer learning to influence decisions. Yet, the literature rarely spotlights farmer connections to increase adoption rates. An interdisciplinary approach can link the social sciences and practice adoption research. The transfer of technology requires a broader interdisciplinary understanding of other fields of study and of decision-making behaviors to promote technology adoption. The Fellow Farmer Effect describes the phenomenon where farmers are significantly more likely to trust a neighbor or peer - a fellow farmer - than they are to trust a third party, such as Extension specialists, researchers, or other consultants. This effect, which is universally acknowledged across the agricultural community, is rooted in a theoretical framework based on the Theory of Mass Communication (Bandura 2001) and Diffusion of Innovation (Rogers 1995). In a previous study, we discovered a severe lack of connection to social theory, with only 6% (n=4) of studies on practice adoption recommending the use of farmer-to-farmer connections. These findings suggest that an interdisciplinary approach could bridge the gap. This is the second stage of a larger project, in which we are trying to move beyond the data to the next stage. Interdisciplinarity is the ideal method to turn this barrier to adoption (i.e., lack of trust in research and Extension) into a tool for technology transfer (i.e., trust among peers). The Fellow Farmer Effect brings theory and technological innovation together to benefit the future of agriculture.

Title: EFFECT OF PELVIS-TRUNK ROTATION TIMING ON FASTBALL xCTRL IN NCAA DIVISION I BASEBALL PITCHERS

Primary Author: Joseph Caplan

Additional Authors: Gretchen Oliver;Adam Hoechstetter;Ian Jump;Ryan Zappa;

Mentor: Gretchen Oliver

Department/Program: School of Kinesiology

College: College of Education

Abstract: Fastball control is paramount in evaluating baseball pitching performance; however, it is challenging to quantify because pitch intent is often unknown. A new expected control (xCTRL) metric addresses this limitation by measuring pitch location relative to a pitcher's historical tendencies, providing a single value that calculates the distance between pitch locations and the nearest predicted zone. Furthermore, kinematic sequencing has been a variable of interest in pitching velocity research, yet its relationship with control is unknown. Therefore, the purpose of this study was to examine the relationship between a pitcher's pelvis-trunk rotation timing and their xCTRL. In-game kinematic data from 42 NCAA Division I pitchers ($1.87 \pm 0.05\text{m}$, $93.2 \pm 7.49\text{kg}$), who threw at least 50 fastballs during the 2023-2025 seasons, were collected (300Hz) using an eight-camera markerless motion capture system. Data were processed and filtered using KinaTrax software. Pelvis trunk timing (PTT), which is defined as the time (ms) from max pelvis rotation velocity to max trunk rotation velocity, was extracted for analysis. A negative PTT value indicated that the trunk reached max rotation velocity before the pelvis, suggesting that the pitcher's upper half rotated open prematurely, causing suboptimal sequential timing. xCTRL was calculated using data retrieved from a TrackMan V3 Game Tracking unit (pitcher and batter handedness, count, pitch location). A linear regression ($\alpha=.05$) was then used to identify the relationship between the pitchers' mean PTT and xCTRL. The average fastball xCTRL from the cohort was 12.33 ± 1.04 , and the regression indicated a significant relationship ($p=.039$, $R^2=.103$), where a 1 ms decrease in PTT led to a 0.32-inch increase in xCTRL. These results indicate that a significant relationship exists between a pitcher's PTT and their xCTRL, and that as the time between pelvis and trunk max rotation velocity increases, their control will generally improve.

Title: Impact of Sense of Agency over Emotions and Neurobiology on Negative Affect

Primary Author: Josephine Pittman

Additional Authors:

Mentor: Samantha Fede

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Although beneficial, neurobiological models of psychopathology are criticized for potentially causing feelings of helplessness. Reduced sense of agency (SOA) is linked to greater negative affect (NA), but the role of neurobiological agency specifically is unknown. To address this, we conducted a pilot study examining associations between SOA, neurobiological agency and NA. Participants ($n=250$) completed online questionnaires assessing general SOA, neurobiological agency (BKQ), and emotional agency (TOER), plus NA (PANAS). BKQ was examined using exploratory factor analysis (EFA). Pearson correlations between resulting factors and the other scales were conducted. Mediation analyses using the mediation package in R examined effects of BKQ and TOER on the association between SOA and NA. EFA of BKQ produced four subscales: beliefs that neurobiology can be changed (BKQ1); neurobiology predetermines traits (BKQ2); neurobiology changes only through biological mechanisms (BKQ3); and neurobiology myths (BKQ4). BKQ1 correlated with SOA ($r=.25$) and NA ($r=-.16$); BKQ2 correlated with SOA ($r=-.25$). As expected, SOA and NA were negatively correlated ($r=-.44$). BKQ factors did not mediate this relationship; TOER was a significant mediator (Total Effect= -0.397 ; Proportion Mediated= 0.313). These results suggest that emotional, rather than neurobiological, sense of agency better explains the relationship between SOA and NA. Thus, increasing patients' sense of control over their emotions may be more effective in treatment of diagnoses involving NA. Neurobiological agency may still influence this perception, and treatments may be improved by giving individuals a sense of control over neural activity, so in follow-up we are examining changes in SOA and NA after an fMRI-based emotion regulation task with or without neurofeedback. If our pilot results are replicated, this would imply that mental health treatments could be both improved and personalized by addressing the role that agency plays in these diagnoses.

Title: Human trophoblast stem cells have an attenuated LPS response but mount a potent interferon-mediated antiviral defense

Primary Author: Joshua Baskaran

Additional Authors: Paige Drotos; Carly Parker; Matthew Brown; Cristine Camp;

Mentor: Rachel West

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: The peri-implantation period of pregnancy requires a finely tuned pro-inflammatory response. Dysregulated inflammation can cause placental dysfunction, leading to early pregnancy loss. In this study, we aimed to elucidate the mechanisms underlying immune imbalance during implantation using a trophoblast stem cell (TSC) model. TSCs represent the cytotrophoblast cells of the peri-implantation placenta and can differentiate into syncytiotrophoblasts (STB), the cells responsible for maternal-embryo communication. TSCs were cultured in stem or STB medium, using human dermal fibroblasts (HDF) as a positive control. Cells were treated with 250 ng/mL lipopolysaccharides (LPS) or 250 U/mL interferon beta (IFNB) for six hours prior to RNA isolation for RT-qPCR. Additional samples were collected for Western blotting at 0, 15, 30, 45 minutes and 24 hours post-treatment. LPS did not stimulate expression of the pro-inflammatory cytokines IL6 or TNFA in TSCs or STBs. In contrast, IFNB significantly increased levels of the interferon-stimulated genes, ISG20, IFITM1, IFITM2, AND IFITM3 ($p < 0.0001$). We next assessed protein levels of phosphorylated ERK (pERK). Compared to HDFs, TSCs had a delayed, modest increase in pERK while STBs showed no response. Alternatively, IFNB treatment for 24 hours increased total levels of STAT1 in all cell types. Finally, we used immunofluorescence to visualize protein localization of NFkB and IRF3 at 0 and 90 minutes post-LPS treatment. At 90 minutes, HDFs exhibited nuclear translocation of NFkB and IRF3 while the STBs and TSCs did not. These findings suggest the peri-implantation stage placenta exhibits limited responsiveness to pathogen-associated inflammatory signals such as LPS but remain highly sensitive to interferons. This implies that the primitive placenta is not directly responsive to microbial stimuli, but rather to maternal immune activation, highlighting the importance of the maternal immune balance in early pregnancy success.

Title: Improving cognitive flexibility in individuals with aphasia

Primary Author: Joshua Deutschendorf

Additional Authors: JungMoon Hyun;

Mentor: JungMoon Hyun

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Aphasia is an acquired language disorder most commonly caused by stroke. Cognitive flexibility (CF) involves adapting to new situations, shifting perspectives, and handling unexpected changes. It is particularly crucial for individuals with aphasia who experience communication challenges, helping them find alternative ways to express themselves and solve problems. However, its characteristics and intervention effects for individuals with aphasia remain understudied, prompting us to examine these questions and to develop an intervention approach. We examined the characteristics of CF, including its definition, measurement methods, intervention approaches, and reported effects through a systematic literature review. Based on this literature review, we design and implement a novel intervention for individuals with aphasia. We conducted a systematic literature review using Covidence. Articles published after 1999, written in English, including a specific measure of CF in individuals with aphasia across five databases were reviewed. A comprehensive review of 142 articles ultimately yielded 16 studies, including experimental and intervention designs. The findings reveal that, among the 16 studies, only 10 explicitly provided a definition of CF. Of these, six defined CF as an executive function, whereas the remaining four offered differing definitions. The studies used diverse measures of CF, mostly one of the executive function measures. Six studies implemented CF interventions, and all reported significant improvements in word-retrieval abilities, and three studies reported additional improvements in CF. These findings underscore the need for consensus on its definition and clearer measurement approaches among researchers and clinicians. They also suggest the potential utility of CF as a tool in aphasia treatment.

Title: A Quantitative Framework for Area Navigation Approach Performance Assessment

Primary Author: Joshua Dobelbower

Additional Authors: Nicoletta Fala;

Mentor: Nicoletta Fala

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Instrument approaches in aviation are paramount to landing aircraft safely in weather conditions where visibility is reduced, with Area Navigation (RNAV) approaches being the most commonly used GPS based procedure. RNAV approaches require extensive training to be performed properly to ensure the safety of the passengers and crew. Current methods of assessing instrument approaches are generally either subjective in nature or simply use pass-fail criteria. The lack of clear or detailed feedback presents the need for an objective, quantifiable, and repeatable assessment to be used in flight training. In this research, an algorithm was developed to identify RNAV approaches by verifying that published approach waypoints were captured within configurable tolerances. This allows for some flexibility in operations, such as allowing for deviations above the prescribed altitude but not below. Once an approach is detected, the performance of the pilot is quantified using a multi-axis scoring algorithm to judge the pilot's accuracy, stability, and procedural compliance. It scores the pilot's accuracy by quantifying the lateral and vertical error against an idealized final approach path. The weight of error is determined by the aircraft's distance to the runway threshold to emphasize a tighter performance requirement during final approach. Stability was scored using the rates of accuracy deviation as well as the consistency in the vertical speed. Finally, the procedural scoring assesses the pilot's ability to follow the published procedure on the final approach fix. This system produces a single numerical score for each approach performed during a flight. The detection and scoring algorithm is designed to be scalable and objective. This algorithm could be applicable in flight-training to set standards and goals for students, continuous pilot performance analysis, accident investigations on approach, or for flight training research.

Title: Vibration Stimulation for Neuropathy: Development and Pilot Study

Primary Author: Joshua Medler

Additional Authors: Chad Rose;Rhet Hailey;

Mentor: Chad Rose

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Diabetic Peripheral Neuropathy (DPN) is a common complication of diabetes mellitus and is associated with pain, numbness, and reduced plantar sensation, which can interfere with balance, mobility, and daily activity. Previous studies using heat and pressure stimulation and studies that use haptic stimulation have both demonstrated potential benefits, motivating the exploration of the combination of the two approaches. This research focuses on the development and pilot evaluation of a tri-modal foot stimulation system that integrates vibration with existing thermal and mechanical pressure stimulation. The system incorporates a programmable haptic array capable of delivering distinct vibration patterns, a pneumatic boot to apply pressure, and heating pads to provide heat to the plantar surface of the foot. To evaluate changes in sensation, an automated plantar sensitivity measurement device applies controlled forces to multiple locations on the foot before and after the intervention. Participants complete a series of treatment sessions over a two-week period, and outcomes are evaluated using both quantitative force detection thresholds and user-reported comfort ratings. This work aims to determine whether the inclusion of vibration stimulation leads to measurable improvements in plantar sensitivity compared to prior dual-modal approaches thus improving the quality of life of those with Diabetic Peripheral Neuropathy (DPN).

Title: The Effectiveness of CAR T Cells as a Treatment Modality for Osteosarcoma in a Canine Model

Primary Author: Joshua Moseley

Additional Authors: Terri Higgins; Payal Agarwal;

Mentor: Payal Agarwal

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Osteosarcoma (OS) is a highly malignant and aggressive form of cancer that arises from mesenchymal cells of bone tissue. This cancer occurs primarily in children and adolescents, usually beginning in the arms or legs, but often spreading throughout the body, commonly metastasizing to the lungs. Osteosarcoma is also the most common malignant bone tumor in dogs. Current treatments include chemotherapies, surgical removal, or even amputation of the limb to prevent further spread. The survival rate hasn't changed over the past two decades, making it essential to research novel treatments. Immunotherapies, such as CAR T cell therapies, show promise in treating solid cancers, including osteosarcoma. We aim to test and demonstrate the CAR T cell efficiency in an osteosarcoma model in vitro using canine osteosarcoma cell lines. We have developed anti-B7H3 CAR T cells and tested them in a GFP-firefly luciferase-expressing canine osteosarcoma cell line, D22-GLP. We have shown that anti-B7H3 CAR T cells can efficiently kill D22 GLP cells in a 2D (monolayer) model. Moving forward, we will assay the cytotoxic effect of anti-B7H3 CAR T cells in the same cell line using a 3D (spheroid) model. We also aim to quantify cytokine secretion levels from CAR T cells in response to osteosarcoma. This study aims to provide insight into the effectiveness of CAR T immunotherapy in treating osteosarcoma.

Title: AEP Inhibition Restores TDP-43 Clearance in Frontal Temporal Dementia

Primary Author: Joyal Xavier

Additional Authors: Rajesh Amin; Meenakshi Singh;

Mentor: Rajesh Amin

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: TAR DNA/RNA-binding protein 43 (TDP-43) is a nuclear RNA-binding protein that becomes mislocalized and forms insoluble aggregates in several neurodegenerative disorders. TDP-43 aggregation is a major pathological hallmark in nearly 50% of Frontotemporal Dementia (FTD) patients. A major contributor to this pathology is Asparaginyl Endopeptidase (AEP), a lysosomal protease that cleaves TDP-43 into highly aggregation-prone C-terminal fragments, driving FTD progression. To target this mechanism, the Amin lab developed a library of AEP inhibitors and identified Compound C as a lead inhibitor designed to block AEP's active site. HT22 hippocampal neurons were treated with ethacrynic acid, a ROS inducer, to stimulate AEP activation, and Compound C was applied to assess inhibition of AEP activity and TDP-43 aggregation via Western blot and immunolocalization in TDP-43-overexpressing cells. Ethacrynic acid robustly induced AEP activation and TDP-43 cleavage, whereas Compound C markedly suppressed active AEP levels and reduced TDP-43 aggregation. Immunofluorescence in GFP-tagged TDP-43 cells demonstrated that Compound C attenuated cytoplasmic and lysosomal TDP-43 accumulation. Ethacrynic acid altered lysosomal acidity and reduced V-ATPase expression, highlighting lysosomal pH control over AEP activity and TDP-43 proteolysis. Compound C restored V-ATPase expression, normalized lysosomal pH, and recovered lysosomal function. Autophagy assays showed ethacrynic acid reduced LC3-II levels, indicating impaired flux, while Compound C restored LC3-II and autophagic activity. Flow cytometry with DAPGreen (525 nm) and DALRed (720 nm) confirmed increased autolysosome formation, showing improved autophagy. Collectively, these findings suggest that targeting AEP with Compound C may represent a promising therapeutic strategy to mitigate TDP-43 pathology in FTD and related neurodegenerative disorders.

Title: Biochar for lead ion removal from aqueous solutions: the effect of inorganic carbonate

Primary Author: Juan Tarlera Esteves

Additional Authors: Thomas Elder;Yucheng Peng;Haiqiu Jiang;Jonathan Lacuesta Cabral;Ruiqi Li;

Mentor: Yucheng Peng

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Biochar, a carbon-rich material that can be produced from forest byproducts and waste, is emerging as a valuable material for removing heavy metal ions from aqueous solutions. Biochar can be produced by many processes and equipment. Among these, mobile air curtain burners, developed to achieve lower levels of particulate matter and smoke than open pile burning, can be deployed in the field where biomass feedstocks are located. This study pioneers in using and characterizing biochar produced by a CharBoss system, a new mobile air curtain burner platform. This study investigated lead ion (Pb^{2+}) removal mechanisms by characterizing seven biochars produced using the CharBoss system. The Pb^{2+} removal capacities ranged from 35 to 224 $mg \cdot g^{-1}$ of biochar. To understand the factors influencing this removal capacity, various physicochemical properties of the biochars were characterized, including the specific surface area, electrical conductivity, zeta potential, and pH. The mineral content, particularly calcium carbonate ($CaCO_3$), was determined by analyzing the X-ray diffraction (XRD) patterns of the biochar samples using the Rietveld refinement method. The mineral content plays a critical role in the Pb^{2+} removal capacity. Precipitates of cerussite and hydrocerussite crystals were observed in the biochar XRD patterns after Pb^{2+} adsorption. A linear correlation was observed between the Pb^{2+} removal capacities of these biochars and the $CaCO_3$ contents. The results indicate that the Pb^{2+} removal capacities of these biochar samples were predominantly determined by the $CaCO_3$ contents through the chemical precipitation mechanism.

Title: The role of hand-rendered watercolor illustration in design communication

Primary Author: Julia Roop

Additional Authors:

Mentor: Meirav Goldhour

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Digital design software has become an industry-standard visual tool for communication between individuals. While computer-generated renderings offer precision and realism, they often lack the flexibility, emotional depth, and interpretive openness needed in early design communication. Research shows that hand-drawn illustrations can convey spatial intent, atmosphere, and materiality without rigid outcomes. Therefore, this project uses watercolor illustration to explore and express spaces by balancing architectural structure with artistic technique, blending controlled linework, perspective, and shadow with watercolor's organic qualities. The method inspires imagination and conversation and gives clients a visual understanding that remains flexible and open to change. Taking inspiration from architects and designers who use hand sketching, this study highlights the value of hand illustration as an immediate design tool for client communication. As digital renderings take over, losing this practice may limit creativity and weaken early client engagement. The project supports maintaining watercolor-based architectural illustration as a creative, relevant alternative that preserves both expressive and architectural intent.

Title: ADT-007: A selective RAS therapy that overcomes drug resistance in GI cancers

Primary Author: Junwei Wang

Additional Authors: Gary Piazza;Xi Chen;Khalda Fadlalla;Kristy Berry;Yulia Maxuitenko;Sindhu Ramesh;Adam Keeton;

Mentor: Gary Piazza

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: RAS mutations are among the most common genetic alterations in human cancer, occurring in approximately 20-30% of tumors and functioning as a constitutively active cellular switch that drives uncontrolled proliferation. These mutations are particularly prevalent in pancreatic ductal adenocarcinomas (PDAC), where they occur in about 95% of cases. Despite this high prevalence, only two FDA-approved RAS inhibitors are currently available, both selectively target KRAS-G12C, a mutation found in only 3% of PDAC cases. This highlights a significant unmet medical need for pan-RAS inhibitors that can address the complex RAS mutational landscape in PDAC and other RAS-driven cancers. ADT-007 is a novel small-molecule pan-RAS inhibitor that selectively targets a broad range of RAS mutations, potently inhibiting RAS mutant cell proliferation with single-digit nanomolar IC50 values, while exhibiting minimal activity in RAS wild-type (WT) cells. Based on the elevated expression of UDP-glucanoyltransferase (UGT) enzymes we observed in RAS WT compared to RAS-mutant cells, we hypothesized that ADT-007 selectivity is enhanced by enzymatic detoxification through glucuronidation in normal cells. In addition, ADT-007 demonstrated superior antitumor activity over other investigational pan-(K)RAS inhibitors, inhibiting RAS-driven colony formation by selectively inducing apoptosis. Importantly, ADT-007 retained its potency in resistant cell lines that are unresponsive to mechanistically distinct classes of RAS inhibitors, whereas other compounds exhibit cross-resistance, losing potency to inhibit RAS mutant cell growth and to suppress MAPK signaling. An orally available prodrug of ADT-007 (ADT-1004) demonstrated favorable tolerability and produced sustained ADT-007 plasma concentrations significantly above growth IC50 values. Daily oral administration of ADT-1004 significantly inhibited RAS signaling and tumor growth in orthotopic and PDX mouse models of pancreatic cancer.

Title: How habitat variation shapes bat activity: Insights for managing public lands

Primary Author: Justin Hall

Additional Authors: Jonathon Valente; Molly Simonis;

Mentor: Jonathon Valente

Department/Program: ALA COOP Fish and Wildlife Unit

College: College of Forestry, Wildlife and Environment

Abstract: Monitoring wildlife on public lands is critical for understanding ecological patterns and informing conservation strategies. These lands often serve as critical habitats for diverse species, and effective monitoring provides evidence needed for adaptive management decisions. Among vulnerable taxa, bats face numerous threats including habitat loss, disease, and climate change, making regular monitoring and evidence-based conservation actions particularly important. To better understand how public lands can support bat populations, we conducted passive acoustic monitoring across Alabama Wildlife Management Areas (WMAs) during summer 2025. Our objective was to evaluate bat activity across heterogeneous habitats within these sites. We deployed acoustic detectors at points randomized based on the proportion of habitat types within each WMA, as determined by NLCD land cover classifications across key habitat types: hardwood forests, pine forests, mixed pine-hardwood forests, forested wetlands, agricultural lands, and openings. This approach allowed us to capture variation in bat activity relative to structural and ecological differences among habitats. Preliminary results indicate that bat activity is not evenly distributed across the landscape. Riparian areas and uneven-aged hardwood stands exhibited consistently higher activity levels, suggesting their importance as foraging and commuting habitats. In contrast, open fields and some pine stands showed limited activity, highlighting potential opportunities for habitat enhancement or alternative management strategies. Additionally, we find that nightly activity is distinct to species and habitats. These findings underscore the value of fine-scale habitat use data for prioritizing conservation actions on WMAs. By linking bat activity patterns to habitat characteristics, land managers can implement targeted strategies that maximize ecological benefits and support long-term bat conservation. This work demonstrates how acoustic monitoring can guide evidence-based management on public lands.

Title: Development of a biosensor for rapid detection of viable salmonella in poultry processing water

Primary Author: Kaniz Kibrea

Additional Authors: Iris Vega Erramuspe; Tanzeel Rehman; Shabarinath Srikumar; Camila Rodrigues; Brendan Higgins;

Mentor: Iris Vega Erramuspe

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Salmonella contamination in poultry processing remains a serious food safety concern. A typical poultry processing plant generates about 30 million gallons of wastewater per month containing high levels of organic matter, nutrients, fats, oils, grease, and pathogenic microorganisms such as Salmonella. Current detection methods rely largely on culture-based enrichment and plating, which take several days and fail to detect viable-but-non-culturable (VBNC) cells of Salmonella. This creates real operational risk. In addition, common stressors encountered during sanitation and wastewater treatment such as heat, disinfectants, nutrient scarcity, and osmotic stress, can push Salmonella into VBNC states, further underestimating pathogen presence using culture-based tests. Conversely, molecular methods often detect DNA from both live and dead cells, potentially overestimating risk, while immunological assays perform poorly in complex wastewater matrices. Although laboratory-scale tools such as viability PCR, fluorescent staining, immunomagnetic separation, and microfluidic biosensors offer improvements, many are still sensitive to complex matrix effects, require specialized infrastructure, or lack integration into a practical workflow. To address these challenges, we aim to develop a rapid, selective biosensor for detecting metabolically active (VBNC) Salmonella in poultry processing waters. The workflow combines pre-enrichment in Tryptic Soy Broth (TSB), selective immunoprecipitation, washing and microscopic analysis coupled with machine learning detection. The present study focuses on the effect of stressors, such as heat and salt, on the efficiency of immunoprecipitation of Green Fluorescence Protein (GFP) modified Salmonella Typhimurium onto anti-Salmonella Dynabeads™. The findings will be essential for achieving the long-term goal of developing a robust, rapid detection platform for detecting metabolically active Salmonella in complex water matrices.

Title: Optimizing ADHD therapy through pharmacogenetic insights: A step toward precision healthcare

Primary Author: Kannathal Ramaswamy

Additional Authors: Muralikrishnan Dhanasekaran;Suhrud Pathak;Keyi Liu;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Neurodevelopmental disorders comprise a heterogeneous group of conditions typically identified in early childhood and characterized by variable clinical features and functional impact. Among these, Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most prevalent. ADHD is defined by persistent patterns of inattention, hyperactivity, and impulsivity that impair academic, social, and daily functioning. Pharmacologic management remains a cornerstone of ADHD treatment and includes two primary classes: stimulants and non-stimulants. Common stimulant medications, methylphenidate and amphetamine derivatives, are considered first-line therapy and act by increasing synaptic monoamines (dopamine and norepinephrine) in the central nervous system. While effective, stimulants may be associated with adverse drug reactions (ADR), including appetite suppression, sleep disturbance, cardiovascular effects, and potential misuse or dependence in susceptible individuals. Non-stimulants, including atomoxetine, certain antidepressants, and alpha-2 adrenergic agonists, primarily modulate norepinephrine pathways and are often selected when stimulants are contraindicated. Despite the availability of multiple therapeutic options, interindividual variability in treatment response, ADR, and allergic manifestations remains a significant clinical challenge. Intriguingly, pharmacogenetic factors influencing drug metabolism, receptor sensitivity, and neurotransmitter pathways may partially explain these differences. This study examines the pharmacogenetic profiles associated with commonly used stimulant and non-stimulant ADHD medications and evaluates how genetic variation may influence efficacy and tolerability. Understanding the pharmacogenetics of ADHD therapies may support more individualized prescribing, improve treatment outcomes, and reduce ADR and allergic manifestations, contributing to a more precise, effective, and patient-centered approach to ADHD management.

Title: Molecular identification and population dynamics of *Ramulariopsis* Species in Alabama cotton

Primary Author: Karamjit Kaur Baryah

Additional Authors: Amanda Strayer-Scherer; Zachary Noel;

Mentor: Amanda Strayer-Scherer

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Areolate mildew is an economically, potentially yield limiting disease of cotton in the southeastern United States. The disease is caused by two distinct fungal species within the *Ramulariopsis* genus - *R. gossypii* and *R. pseudoglycines*. Traditionally, *R. gossypii* has been the predominant species found in the southeast. However, *R. pseudoglycines* was recently identified in Mississippi, Georgia, and Tennessee cotton fields in 2022. The objective of this study was to characterize the distribution of these two *Ramulariopsis* species in Alabama and determine sensitivity to QoI fungicides. Cotton leaf samples exhibiting areolate mildew symptoms were collected from major cotton-producing regions of the state, including central and south Alabama, during 2023 (n=10), 2024 (n=15), and 2025. The isolate collection from 2025 also includes samples from Mississippi and Tennessee. Fungal isolates were obtained from symptomatic tissues, and DNA was extracted for molecular identification. The ITS, ACT, TEF1 α , HIS3, and RPB2 gene regions were amplified and sequenced to confirm species identity. Sequencing results confirmed the mixed presence of *R. gossypii* and *R. pseudoglycines*. Further, phylogenetic analysis was conducted to assess evolutionary relationships among *Ramulariopsis* isolates collected from Alabama cotton fields in comparison with previously characterized isolates from Brazil and other regions. The resulting phylogenetic tree revealed clustering patterns distinguishing *R. gossypii* and *R. pseudoglycines*, with Alabama isolates grouping closely with known reference sequences from Brazil. This is the first time that *R. pseudoglycines* has been detected in Alabama. Pathogenicity of *R. pseudoglycines* has also been confirmed by Koch's postulates. *R. pseudoglycines* isolates were tested for cytb gene mutations at G143 position for resistance against QoI fungicides. None of the *R. pseudoglycines* isolates showed any mutations, which likely means all the isolates are sensitive. Future research will evaluate the fungicide sensitivity of these isolates to commercial fungicides, including triazoles, strobilurins, and carboxamides.

Title: Expanding donor cell types for xenogenic catfish production

Primary Author: Kate Pottle

Additional Authors: Rex Dunham; Ian Butts; Homnath Dhakal; Teresa David; Nadeen Abdo; Dhanuka Bambaranda Hewage; Misha Soman; Brendan Leibert; Kieran Stein; Kailyn Shealy; David Baker; Ahmed Elewa Shaaban; Mei Shang; Baofeng Su; Darshika Udari Hettiarachchi;

Mentor: Rex Dunham

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Hybrid catfish (♀ channel catfish, *Ictalurus punctatus* × ♂ blue catfish, *I. furcatus*) account for over 50% of U.S. catfish production due to superior performance compared to the parent species. One method being developed to efficiently produce hybrids is xenogenesis, which involves transplanting donor cells from one species into a sterile surrogate fish. In catfish, unsorted gonadal cells from immature diploid blue catfish are transplanted into sterile triploid channel catfish or white catfish (*Ameiurus catus*) fry. These surrogates later produce donor-derived gametes and, when mated, generate 100% hybrid offspring. A major limitation of this approach is that the best-performing donor fish can only be identified once they reach sexual maturity. By that time, their gonadal stem cell numbers are low, which limits the number of offspring that can be produced from their donor cells. Therefore, alternative donor cell sources are needed to improve the efficiency of xenogenic catfish production. The objective of this study was to evaluate new donor tissues as potential cell sources for xenogenesis. Triploid channel catfish and white catfish fry were injected at 5 days post-hatch (DPH) with fresh or cryopreserved cells from kidney, spleen, intestine, skin, or gonadal tissue. Survival, growth, and donor cell colonization were evaluated at 45 and 90 DPH. PCR and PKH26 fluorescent imaging were used to determine the presence of donor cells in surrogate gonadal tissue. Kidney, spleen, and gonadal cells successfully colonized surrogate gonads, while intestine and skin cells did not ($P < 0.05$). Gonadal cells exhibited the highest levels of colonization, followed by kidney cells, and both performed better than spleen cells ($P < 0.05$). Fresh cells consistently resulted in greater colonization and survival than cryopreserved cells across all donor tissues ($P < 0.05$). No differences in surrogate performance were observed between channel catfish and white catfish ($P > 0.05$). These results demonstrate that kidney cells could be a viable donor option, and potentially spleen cells as well, for the creation of xenogenic catfish. Cryopreservation can be used, although with reduced efficiency. Expanding donor cell options can support the development of domestic hybrid catfish production.

Title: Dementia Confidence, Attitude, and Knowledge in Nursing Students and Nursing Home Staff

Primary Author: Kate Winkelman

Additional Authors: Whitnie Willis;

Mentor: Hae Sagong

Department/Program: Nursing

College: College of Nursing

Abstract: Effective communication with individuals with dementia is essential for quality care, yet healthcare providers often report feeling unprepared. Understanding how confidence in dementia communication differs between nursing students and practicing nursing home staff can inform targeted educational interventions. The purpose of this study was to examine the differences in dementia knowledge, confidence in communication, and attitudes toward individuals with dementia between nursing students and nursing home staff. This study is a quantitative, cross-sectional, comparative survey design. From June to October, Auburn University nursing students (n=28) and newly employed nursing home staff in Alabama (n=13) completed an anonymous Qualtrics survey including three validated instruments: Confidence in Dementia Communication Scale (CODES), Dementia Attitude Scale (DAS), and Dementia Knowledge Assessment Scale (DKAS). Comparative analysis examined differences in confidence levels, knowledge accuracy, and attitudes. Nursing home staff demonstrated significantly higher confidence than students ($M \pm SD$: 3.82 ± 1.00 vs. 2.59 ± 0.89), with the largest gap in managing agitation (3.70 ± 0.82 vs. 1.85 ± 0.87). Staff also demonstrated more positive attitudes (4.05 ± 0.45 vs. 3.45 ± 0.87). However, students showed higher theoretical knowledge (19.18 ± 3.55 vs. 15.40 ± 6.20), with staff showing particularly low scores on items assessing sudden onset recognition, prognosis understanding, and medication management approaches. In conclusion, clinical experience builds confidence in dementia communication but does not guarantee comprehensive theoretical knowledge. These findings suggest that nursing students need practical confidence-building experiences, while nursing home staff require formal continuing education on dementia theory. Interventions should focus on simulation-based training for students and evidence-based dementia education for staff to improve person-centered care.

Title: Identifying Biopsychosocial Factors in Partners of Younger Patients with Colorectal Cancer

Primary Author: Katherine Day

Additional Authors: Maren Weathers;

Mentor: Joshua Novak

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Colorectal cancer is the second leading cause of cancer-related deaths in the United States. Within the past 25 years, the incidence and death rates of colorectal cancer in individuals younger than 50 years old have been increasing. Beyond its physical implications, colorectal cancer often places a significant emotional, relational, and lifestyle burden on the patient, their spouse, and the marital relationship. Compared to many other cancers, colorectal cancer often requires significant and ongoing lifestyle changes, including dietary adjustments, long-term treatment, surgical interventions, and, in some cases, colostomy bags. Because colorectal cancer directly affects the gastrointestinal system, the disease can severely disrupt one's quality of life and daily functioning. Though we understand the general mental and physical impact that health problems cause on spouses, limited research exists on how patients and their spouses adjust to a colon cancer diagnosis, especially in younger populations. This gap in knowledge is especially concerning, given the rise in cancer rates in younger individuals. The purpose of this study is to examine how a colorectal cancer diagnosis impacts the physical health, emotional health, and relationship quality of the patient's spouse. Participants will be recruited via social media and targeted Facebook groups and will complete a Qualtrics survey using a snowball sampling design. The survey will measure demographics, coping and adjustment, relationship quality, physical health, and health behaviors before and after their spouse's diagnosis. Health outcomes within a marital relationship are deeply interconnected, making this study highly relevant to thousands of couples in the United States. The results from this study have the potential to significantly inform future research as well as multidisciplinary approaches to family-based prevention and intervention in spouses with colorectal cancer.

Title: Tree mortality in long-unburned, densified longleaf pine stands following wildfire and re-entry prescribed fire

Primary Author: Kathleen Gabler

Additional Authors:

Mentor: Heather Alexander

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Decades of fire exclusion in historically open-canopied montane longleaf pine forests have resulted in stand densification, mesophytic encroachment, and increased fuel accumulation, creating challenges for fire reintroduction and restoration. In long-unburned systems, wildfire and prescribed fire may differ in their effects on overstory mortality across functional groups, with important implications for restoration outcomes and management decisions. This study presents preliminary results from an ongoing investigation of long-unburned montane longleaf pine stands in Central Alabama that experienced either dormant-season prescribed fire or wildfire in 2023 or 2024. Overstory mortality was assessed across functional groups, including longleaf pine, upland oaks, and mesophytic hardwoods. Mortality was significantly higher following wildfire than prescribed fire in upland oaks (15.2% vs. 0.0%) and mesophytic hardwoods (7.4% vs. 0.0%), while longleaf pine mortality did not differ between fire types (7.0% wildfire vs. 7.3% prescribed). These results indicate that although some mortality among restoration-target species may be unavoidable during fire reintroduction, prescribed fire avoids the broader, less selective mortality associated with wildfire. Overall, findings support re-entry prescribed fire as a more predictable and strategic tool for fuel reduction and structural restoration in long-unburned, densified longleaf pine ecosystems.

Title: Knowledge and perceptions regarding xylazine and xylazine test strips among the U.S. general public

Primary Author: Kathlyn Smith

Additional Authors: Lindsey Hohmann;Jingjing Qian;Emma Tidmore;Samuel Efird;Autumn Randles;

Mentor: Lindsey Hohmann

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Xylazine, a veterinary tranquilizer not approved for human use, has been increasingly identified as an adulterant in illicit fentanyl. In 2022, the Drug Enforcement Administration reported that 23% of fentanyl powder and 7% of fentanyl pills seized contained xylazine, thus increasing the risk of respiratory depression and overdose-related death among individuals who may be unaware of its presence. Public awareness of xylazine remains limited, and many individuals who use drugs do not recognize xylazine by name or understand its associated health risks. Xylazine test strips represent a harm-reduction strategy that allows detection of xylazine in drug supplies and may help prevent accidental overdose. This cross-sectional study aims to assess the U.S. general public's knowledge and perceptions of xylazine and xylazine test strips. Adults aged 18 years and older residing in the United States will be recruited through Amazon Mechanical Turk (MTurk) to complete an anonymous electronic survey. Survey items are guided by the Health Belief Model and assess knowledge and awareness of xylazine and test strips, attitudes toward xylazine, perceived benefits and barriers to test strip use, perceived susceptibility and severity of xylazine-related harms, and intentions to use test strips within the next six months. Responses will be measured using 5-point Likert-type scales and analyzed using descriptive statistics. Data collection is ongoing and expected to be completed by March 2026, with an anticipated sample size of approximately 300 participants. Findings are expected to identify gaps in knowledge and regional differences in perceptions of xylazine and xylazine test strip use, and may inform future educational initiatives and harm-reduction strategies aimed at improving awareness, reducing barriers to test strip utilization, and supporting overdose prevention efforts.

Title: Agentic AI for Converting Construction Floor Plans into Robot-Navigable Maps

Primary Author: Kathryn McEniry

Additional Authors: Eric Wetzel;

Mentor: Eric Wetzel

Department/Program: McWhorter School of Building Science

College: College of Architecture, Design and Construction

Abstract: Construction floor plans are information-dense documents containing physical geometry (walls, doors, openings) and non-physical architectural annotations (gridlines, dimensions, tags, callouts). While these drawings are central to estimating, planning, and site coordination, their format is not machine friendly. Current market vision-language models (VLMs) and multimodal large language models (LLMs) show strong performance on natural images and structured documents but remain brittle when analyzing building plans where the physical layout “signal” is interwoven with annotative “noise”. This research introduces a dual-memory, multi-agent framework able to “clean” raster image plans by removing notes while preserving navigable layout information, e.g., distinguishing a dimension line from a thin-partition wall. In this framework, a perception agent processes the drawing, a decision agent selects processing parameters, and an evaluation agent scores the output to guide future trials. Each produced floor plan is evaluated by the final agent and reviewed by researchers on a scale from 0-100 based on preservation of wall structures, gridline removal, and noise reduction. Collectively, these items represent the usability for robotic navigation. High-scoring outputs above 70 have been recorded and are stored as successful examples, while unsuccessful trials are retained to avoid repeated failure. The addition of a memory guided process shows 20% improvement from non-memory processing within the same pipeline. These results show agentic AI’s growing ability to differentiate pixels in construction plans that represent tangible physical structures from annotative pixels. This is the first step toward AI comprehension of floor plans, and potentially other drawing types such as elevations or section cuts. This framework establishes a foundation for autonomous AI comprehension across the lifecycle of construction documentation.

Title: Sustaining impact: Evaluating efficiency and effectiveness in the Alabama Youth Relationship Education (AYRE) project and similar programs

Primary Author: Katie Biddle

Additional Authors:

Mentor: Julianne McGill

Department/Program: Special Ed, Counseling Psychology and School of Psychology

College: College of Education

Abstract: The Alabama Youth Relationship Education project has served over 50,000 youth since its inception as a federally funded project in 2002. It has done this across Alabama in classes at over 40 high schools. The project and its programming serve youth by educating them through informative presentations and interactive activities. Topics covered include friendship, conflict management, stress management, dating, breaking up, and staying safe in intimate partner relationships. A question that continually comes up in the leadership and planning for these types of programs is which to prioritize: efficiency or effectiveness. Limited effectiveness, despite efficiency gains, results in a programming model that fails to achieve the researcher's goals. On the other hand, limited efficiency fails to make good use of the program's resources and opportunities. The research conducted was a literature review on the AYRE program and similar relationship education programs. The studies were identified using the key phrases "classroom management strategies," "school counseling classroom interventions high school," and "youth relationship education." Internal data from the AYRE project was also referenced for program information and records, studying changes in program policy and results from participant surveys. Several approaches were identified to improve the efficiency and effectiveness of youth relationship education and related high school psychoeducation programs. These methods of improvement include providing more opportunities for students to engage with the material digitally or tactually, using a near-peer service-learning model, utilizing engaging classroom management strategies, and providing more resources for non-English-speaking students. Some of these methods are already being utilized; others are yet to be harnessed to improve these programs. All the discovered methods show promise for improving effectiveness, efficiency, and engagement in these programs.

Title: Morphological trait differences of Japanese Climbing Fern between its native and invasive range

Primary Author: Kayin Dunn

Additional Authors: Claudia Stein; Madison Young;

Mentor:

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Non-native invasive plant species out-compete native organisms, reducing biodiversity and altering the abiotic environment, causing environmental and/or economic damage in their introduced ranges. Morphological traits like plant size or leaf area influence the fitness of a plant. Assessing trait differences of species in their native and exotic ranges can help identify underlying mechanisms that might allow a species to become invasive in novel environments. We used digitized natural history collections to investigate whether internode length and leaf area of *Lygodium japonicum* differ in their invaded range compared to their native range. *Lygodium japonicum*, commonly known as climbing fern, is vine-like fern that is native to Eastern Asia and invasive in the southeastern US. Our results showed that internode length was significantly higher in its exotic range compared to its native range, while we found no differences in apical leaf area. Having longer internodes in the introduced ranges might indicate rapid adaptation to the new environment, or lower competition or lower herbivore pressure in the invasive range allowing the plant to invest more in plant growth and less in defense.

Title: Human perceptions of tigers & tiger conservation in Telangana, India

Primary Author: Keerthi Krishna Devulapally

Additional Authors: Allie McCreary;

Mentor: Allie McCreary

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The tiger (*Panthera tigris*) is an endangered species across Asia, including India, yet its populations are poorly understood and limited due to poaching, habitat loss, and isolation. Although global conservation efforts exist, long-term tiger survival depends heavily on local community support for monitoring, habitat management, and reducing human–tiger conflict. This research investigates the perceptions of individuals living near two tiger reserves in Telangana, India: Amrabad Tiger Reserve (ATR) and Kawal Tiger Reserve (KTR). The purpose of this research is to understand the perceptions of individuals living near tiger reserves, specifically, their level of tiger sightings, what they perceive as threats to tiger survival, and their attitudes around the importance of tiger conservation. To assess these perceptions, quantitative data were gathered via an intercept survey, from core, buffer, and relocated communities between June and September 2025 (n=621). Results indicate that more than half of the respondents reported having seen a tiger or having a family member who had seen one, with significantly higher levels of tiger sightings in ATR than in KTR. Habitat loss, declining prey populations, and human-tiger conflict were perceived as more serious threats in KTR than in ATR, while poaching and free-roaming dogs were widely viewed as minor threats in both reserves. Despite differences in perceived threats, strong support for tiger conservation was found across both reserves, particularly in ATR core and relocated communities. These results illustrate that individuals' experiences with tigers and their proximity to each tiger reserve significantly shape their perceptions of conservation issues. Understanding these local perspectives is essential for developing tiger conservation initiatives that address community demands and contribute to long term conservation success.

Title: Before the Bedside: Exploring Student Perceptions of Nursing to Strengthen Career Commitment

Primary Author: Kendall Henderson

Additional Authors: Carlie Hunt;Caitlin Moore;

Mentor: Jill Salisbury-Glennon

Department/Program: Educational FLT

College: College of Education

Abstract: Students in professional programs are increasingly entering training amid workforce instability, limited experiential exposure, and uncertainty about professional roles, which may hinder early professional identity formation. Professional identity formation is a developmental process shaped through early socialization, role clarity, and reflective meaning-making. This study examined how pre-clinical nursing students conceptualize the professional role of the nurse, factors influencing those perceptions, and how role understanding shifts following theory-informed instruction delivered prior to clinical training. Using a qualitatively driven mixed methods design, pre- and post-class reflections and survey data from 116 pre-clinical nursing students were analyzed. Instruction included structured, AACN Essentials-aligned content addressing professional roles, values, and person-centered practice, delivered through guided discussion and reflective activities. Pre-class reflections were deductively coded to professional role domains and analyzed using chi-square tests, while post-class reflections underwent inductive thematic analysis. Before instruction, students primarily emphasized relational and task-based aspects of the professional role. Prior healthcare experience minimally influenced role conceptualization but shaped sources of perception. Following instruction, four themes emerged: expanded understanding of professional roles, shifts in perceived priorities, recognition of self-care as a professional responsibility, and adoption of a more holistic view of service recipients. These findings suggest that early, intentional instruction on professional roles and values can support professional identity formation and better prepare students for the complexity of professional practice. The results have implications for professional education broadly, highlighting the value of early, reflective, role-clarifying instruction across disciplines.

Title: Sexual Identity Development in Individuals with Intellectual and Developmental Disabilities: Counseling Strategies for Addressing Sexual Stereotyping and Promoting Sexual Health and Satisfaction

Primary Author: Kendall Kaiser

Additional Authors:

Mentor: Jill Meyer

Department/Program: Special Ed, Counseling Psychology and School of Psychology

College: College of Education

Abstract: Sexual health and satisfaction are components of overall health that are equal in importance to mental, physical, and cognitive well-being. Despite the impact of sexual health and satisfaction on an individual's overall rating of health, individuals with disabilities are met with additional barriers to receiving adequate healthcare and developing a healthy sexual self-concept. This is in large part due to societal stereotypes placed on individuals with disabilities – ones that are commonly faced prior to sexual development. Common societal stereotypes regarding the sex lives of people with disabilities include (and are not limited to) one or more of the following: asexuality, relationship incompetence, and continual infantilization. These stereotypes, which are frequently accepted at a very early age, have a significant impact on an individual's sexual identity development, self-esteem, relationship-building skills, and overall sexual health and satisfaction. Addressing sexual health and satisfaction is vital in the counseling room, as counseling professionals have a duty to promote each aspect of their client's welfare. Certain strategies, such as trauma-informed work, strengths-based counseling, and addressing internalized stigma, when employed in the counseling space, can help to mitigate the effects of sexual stereotyping on people with intellectual and developmental disabilities (IDD) while helping to develop a healthy self-concept. Drawing from current literature, this academic analysis explores how stereotyping affects the sexual identity development of adults with IDD, the general feedback of individuals with disabilities about access to, and satisfaction with, reproductive health and sexual well-being, and possible counseling approaches to be used in-session to respond to stereotyping of individuals with IDD. Strong emphasis is placed on the role of counselors in mitigating the effects of stereotyping, including advocacy for clients and the fostering of healthy counseling spaces which support the sexual health, satisfaction, and autonomy of people with IDD.

Title: When Stress Fuels Cancer: Physical and Psychological Stressors Shape Tumor Growth and Immunity

Primary Author: Kenli Myers

Additional Authors:

Mentor: Kari Dugger

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Breast cancer remains a leading cause of cancer-related morbidity worldwide, with 10–15% of cases classified as triple-negative breast cancer, an aggressive subtype associated with poor prognosis and limited treatment options. Moderate aerobic exercise is increasingly recommended as an adjunct to cancer therapy: reducing fatigue, improving quality of life, and alleviating symptoms of depression. However, the biological mechanisms underlying the effects on tumor progression and cancer immunity remain unclear. This study investigated the combined and independent effects of physical exercise and psychological stress on tumor growth and cancer immunity. Female BALB/c mice implanted with hormone-insensitive EMT6 murine breast cancer cells were assigned to one of four treatment groups: (1) sedentary/non-stressed control, (2) moderate aerobic exercise, (3) unpredictable chronic mild stress, or (4) combined exercise and mild stress. All mice received subcutaneous injections of 5×10^5 EMT6 cells prior to initiating interventions, which were maintained for 24 days. Tumor growth and immune parameters were assessed at study completion. Contrary to expectations, moderate aerobic exercise and chronic mild stress, each independently and together, increased tumor growth as compared to sedentary controls. Interestingly, exercise alone enhanced tumor-killing immune activity; however, this benefit was eliminated when exercise was combined with psychological stress. These findings suggest that behavioral interventions such as exercise may not universally suppress tumor progression and may interact with tumor-specific biology in complex and context-dependent ways.

Title: Pharmacological characterization of calebin A in hippocampal and dopaminergic neuronal models

Primary Author: Keyi Liu

Additional Authors: Timothy Moore;Satyanarayana Pondugula;Preston Cook;Suhrod Pathak;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Calebin A is an amorphous yellow powder and a non-curcuminoid compound that belongs to the ferulate ester family, which is naturally found in turmeric (*Curcuma longa*). It has been reported as a bioactive constituent associated with multiple beneficial pharmacodynamic activities. Based on our previous study, Calebin A exhibits protective effects against an exogenous neurotoxin in hippocampal and dopaminergic neurons at different concentrations. Building on this foundation, the present study further integrates pharmacokinetic (PK) parameters with pharmacodynamic (PD) evaluation to comprehensively assess its potential relevance in neurodegenerative disease models. The experimental part employed the HT22 and N27 cell lines to investigate cholinergic-and dopaminergic-associated mechanisms, respectively, with particular emphasis on oxidative stress, mitochondrial function, inflammation, and apoptosis. In addition, RNA sequencing analysis was conducted to characterize global transcriptional changes and pathway modulation following Calebin A treatment. The results suggest that Calebin A modulates key signaling pathways related to choline-and dopamine-associated neuronal function, and its effective concentration in vitro shows a certain degree of correlation with its in vivo exposure range. This study provides preliminary PK–PD integrative evidence supporting further mechanistic exploration of Calebin A in neurodegenerative diseases.

Title: From models to machines: enabling interoperability across the digital thread in small and medium-sized manufacturers

Primary Author: Khloud Alzubi

Additional Authors: Christian Zamiela;

Mentor: Christian Zamiela

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: This work presents the need to establish seamless interoperability and a continuous digital thread across design, manufacturing, and quality inspection. Many small and medium-sized manufacturing enterprises still do not utilize Model-Based Definition (MBD) to ensure consistency across these phases, resulting in limited end-to-end data continuity. Although standards such as STEP AP242, MTConnect (real-time machine data exchange), and QIF (quality inspection data modeling) operate effectively within their individual domains, they remain difficult to integrate in practice. Bridging this gap requires a model-based systems engineering approach that aligns these standards to enable automated, traceable, and closed-loop information exchange throughout the product lifecycle. Our research develops a semantic and functional integration methodology using domain ontologies to connect features and concepts across lifecycle standards. The framework captures categorical relationships, characteristics, and causal dependencies aligned with manufacturing workflows. This enables bidirectional traceability of design specifications, process parameters, and quality data, supporting resource-constrained manufacturing contexts. Validation is performed through controlled machining experiments. CAD models with embedded Product Manufacturing Information (PMI) are integrated with operational machining data. Experiments vary tool geometry, material type, cutting parameters, and operation sequences to examine their influence on dimensional accuracy and surface quality. Results demonstrate improved traceability across design, manufacturing, and inspection, tighter linkage between process parameters and quality metrics, and reduced manual data translation—supporting more consistent quality in small-scale manufacturing. Ongoing work explores knowledge graph representations and machine learning approaches for automated feature correspondence across standards.

Title: RNA sequencing and deconvolution techniques for equine sarcoids

Primary Author: Kira Noordwijk

Additional Authors: Xu Wang;Reid Hanson;Lindsey Boone;

Mentor: Bruce F. Smith

Department/Program: Clinical Sciences

College: College of Veterinary Medicine

Abstract: Equine sarcoid is a common skin tumor of all breeds, colors, and ages worldwide. Sarcoids can interfere with riding equipment, leading to loss of use. Several treatment options are available, but aggressive sarcoids are often non-responsive. Functional therapies, rationally designed on the molecular basis of these tumors, would allow horses to remain in training and use. Sarcoid tissue samples were collected from horses presented to the Auburn University, J.T. Vaughan Large Animal Teaching Hospital (AULATH). Samples were flash frozen in liquid nitrogen at the time of harvest. While frozen, the samples were crushed in a mortar and pestle on dry ice for storage. For single nuclei isolation, 150 mg of tissue was dissociated in lysis buffer, washed, filtered, and reconstituted in a buffer solution. A magnetic label and filtration system (MiltenyiBiotec©) was used to remove excess debris, and the nuclei fixed (Fixation Kit, ParseBiosciences©). For bulk RNA sequencing, 300 mg of tissue sample was divided into two 1.5 mL conical vials, treated with Tri-Reagent, and homogenized using a Bullet Blender and beads (NextAdvance©). Samples were incubated in Bromochloropropane, washed with isopropanol and ethanol, and the RNA pellets resuspended in nuclease-free water. Samples were submitted to an outside laboratory for sequencing. The single nuclei protocol produced excellent quality but low numbers of nuclei. The optimal concentration for single-nuclei sequencing library preparation is 700-1,200 nuclei/ μ L. Adjustments are needed to continue with the protocol to produce adequate results for sequencing. Adding a step to sort cell in a cell counter is being considered to improve the quality of samples prior to library preparation. Bulk RNA sequencing data will be processed using deconvolution methods, such as Bayesian modeling. Comparison to single-cell data will identify if these methods can be used in the future for larger sarcoid sequencing studies with this easier and less costly method.

Title: The impact of manure application on the spread of antimicrobial resistance and residues across plant tissues – A systematic review and meta-analysis

Primary Author: Kiranmayee Bhimavarapu

Additional Authors: Laura Huber; Kelly Weigand; Alan Wilson; Gourav Chahal;

Mentor: Laura Huber

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Manure application, which is widely used in agriculture to increase soil fertility, is a key contributor to the dissemination of resistant bacteria and antimicrobial resistance genes (ARGs) on agricultural lands. Moreover, antimicrobial resistance (AMR) also spreads from manure-amended soil to roots and phyllosphere, including stems, leaves, and flowers. This review combines multiple studies to better understand the dissemination of AMR from manure-amended soil to plants, and its significance to public health. A meta-analysis was performed using a systematic search in relevant databases (including CAB Abstracts and Web of Science among others) using terms related to manure, antibiotic resistance, and plant parts. To be included in the meta-analysis, studies were screened at the level of title/abstract then full-text, and were only included if they adhered to strict inclusion and exclusion criteria that ensured they compared evidence of AMR (abundance of ARG and/or mobile genetic element determined via quantitative PCR, or presence of antibiotic residues) in plant parts from plants grown in manure-amended soil to those grown in non-manure-amended soil. 57 studies met these criteria and were selected for data extraction. Reported qPCR data including abundance means, error in treatment and control means, will be extracted from the selected studies. To express the differences in AMR between manure and no manure-amended environments, a log response ratio (RR) will be used. A positive Log RR value indicates higher resistance genes in treatment groups than controls. A random effect model and heterogeneity analysis will be conducted to observe the pooled effect sizes and variability across studies respectively. With the above analysis, we hypothesize that plants grown in manure-amended soils are likely to carry higher levels of AMR compared to those grown in soils without manure amendment.

Title: Novel Compounds Play a Significant Role in Reducing the Survival of pentadrug resistant Salmonella Typhimurium

Primary Author: Kripa Pancholi

Additional Authors: Laura Huber; Hunter Sheffield; Greeshma Bharathan;

Mentor: Shabarinath Srikumar

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The global rise of antibiotic-resistant bacteria poses a serious threat to public health and food safety. Increasing resistance in foodborne Salmonella has reduced the effectiveness of conventional antibiotics, highlighting the need for alternative antimicrobials such as natural phenolic compounds that can limit bacterial survival or restore antibiotic activity. This study aimed to assess the antimicrobial activity of 4-hydroxycinnamic acid (4-HCA), a naturally occurring phenolic compound with a diverse library of novel synthetic compounds, against drug-resistant Salmonella Typhimurium. The ability of these agents to inhibit bacterial growth, enhance antibiotic performance, and reduce bacterial survival was evaluated in both multidrug-resistant and antibiotic-sensitive Salmonella strains. Antimicrobial efficacy was examined using minimal inhibitory concentration (MIC) assays, checkerboard synergy testing, and time-kill kinetic analyses. The multidrug-resistant S. Typhimurium DT104 strain served as the primary model organism, while the antibiotic-sensitive strain ST4/74 was included to determine whether compound activity was independent of resistance profiles. MIC values were consistent across replicates, indicating reproducible inhibitory effects. Synergy testing revealed a strong interaction between 4-HCA and chloramphenicol, resulting in significantly reduced bacterial survival. Growth kinetics were statistically analyzed using Student's t-test. Several synthetic compounds demonstrate notable antimicrobial activity at low concentrations and enhance the efficacy of conventional antibiotics. Additionally, selected compounds, including 4-HCA, were effective against E.coli, suggesting broader antimicrobial potential. Overall, these findings indicate that 4-HCA and select synthetic compounds exhibit significant activity against both resistant and sensitive Salmonella, highlighting their potential application in food safety interventions and antimicrobial development.

Title: Electrostatic Dehydration of Cellulose Fiber

Primary Author: Krish Hareshbhai Patel

Additional Authors: Lorenzo Cremaschi;Jonah Henry;

Mentor: Lorenzo Cremaschi

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Paper manufacturing is a highly energy-intensive process. The drying process typically consumes 80% of the total steam and more than 65% of the total energy required in the paper mills. Producing paper involves grinding lumber into pulp and then forming it into a moist sheet of fibers. After pressing, these sheets contain a water content of about 50-60%. Reducing the water content further requires heating the sheet to evaporate the moisture from the sheet. This study investigated a novel dehydration process that aims to minimize thermal heating, increase drying speed, and save energy. The new process is based on dielectrophoresis, in which electrostatic forces removed the water molecules from the sheets. Water molecules adhere to cellulose fibers through hydrogen bonding, van der Waals forces, electrostatic forces, and hydrophobic interactions. Previous work showed that using a spatially divergent electrostatic field increased drying speed and reduced energy consumption. The research question of this study was whether the presence of additional minerals in the sheets could further enhance the extraction of water molecules via dielectrophoresis. Building on previous work from the author's laboratory, this study presents new results of modified TAPPI samples containing small concentrations of CaCO_3 and NaCl . We designed a test setup in which we suspended an electrode with high voltage potential above the sheet in a temperature- and humidity-controlled wind tunnel. We set the humidity control to 70% RH, the air velocity was 2 m/s, and the temperature was 25°C. Preliminary tests conducted using commercially available printing paper showed over 20% higher dehydration rate, whereas standard TAPPI handsheets ranged between 6-18%. Results indicated that, up to a certain moisture content, the newly developed drying method presented in this work required less energy to extract moisture than the thermal heating method. These results informed future scaling potential for the technology and deliver a techno-economic analysis of electrostatic-assisted paper drying technology.

Title: Development of a fluorescence-based sensor for monitoring airborne ammonia

Primary Author: Krishna Neupane

Additional Authors: Iris Vega Erramuspe; Jeremiah Davis;

Mentor: Iris Vega Erramuspe

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Ammonia is a major airborne contaminant in poultry farming, and prolonged exposure above safe thresholds can negatively affect worker safety, animal health, and farm productivity. Current monitoring techniques, such as electrochemical sensors, metal oxide semiconductors, and spectroscopic methods, often suffer from high cost, complex equipment, slow response and recovery, and frequent calibration, limiting their practical on-site use. As a result, there is a strong need for a practical, reliable, and affordable system for real-time detection. This work presents the development of photo-responsive rhodamine-based membranes for ammonia detection. The sensing mechanism relies on the reversible structural transformation of Rhodamine-B (dye) from its closed, colorless spiro-lactone form to an open, colored, and fluorescent form upon interaction with ammonia. Membranes were fabricated using ethyl cellulose as the polymer matrix and glyceryl triacetate as a plasticizer, yielding transparent films with an average thickness of ~0.15 mm and a density of 0.485 g/cm³. Performance was evaluated by exposing the membranes to controlled ammonia concentrations generated by a custom-built gas mixer, calibrated over the range of 0–25 ppm using the salicylate method. Wettability was measured via contact angle, FTIR confirmed dye incorporation, and SEM revealed a rough, microporous, phase-separated surface with evenly distributed dye domains, supporting suitability for diffusion-controlled sensing. These photo-responsive membranes provide a practical, low-cost, and easily deployable alternative to conventional ammonia sensors, offering fast, reliable, and visual detection. Their simplicity and low power requirements make them ideal for on-site monitoring in poultry farming and other settings.

Title: Predicting signaling partners of toll-like receptors in echinoderms with a bioinformatic approach

Primary Author: Kristen Herd

Additional Authors: Kate Buckley; Nick Kraieski;

Mentor: Nick Kraieski

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Echinodermata is a phylum of pentaradially symmetrical marine invertebrates such as sea stars, sea urchins, sea cucumbers, brittle stars, and feather stars. Study of echinoderms led to the discovery of phagocytosis, the identification of cyclins, and the characterization of the mechanisms of fertilization. The larvae of echinoderms are also useful immunological models due to their translucent bodies and distinct immune cell populations, which can be studied in vivo. Echinoderm genomes encode expanded repertoires of genes that recognize pathogens, such as Toll-like Receptors (TLRs). Recognition of pathogens by TLRs leads to a transcriptional response (e.g., immune effectors, cytokines, programmed cell death). TLRs signal via their TIR domains, which interact with the TIR domains of proteins adapters. While vertebrate TLRs have multiple known adapters, including TRIF, TRAM, and MyD88, only MyD88 has been identified in echinoderms and their sister clade, the hemichordates. Furthermore, these genomes contain numerous TIR proteins whose functions are unknown. Notably, some of these proteins share features with a structurally distinct vertebrate TIR protein, the enzyme SARM1. This work sought to identify candidate TLR adapters by classifying uncharacterized TIR domains as SARM1-like or adapter-like. To accomplish this, protein sequences from 22 species of echinoderms and hemichordates were collected from NCBI and elsewhere. One-sequence-per-gene protein files were prepared with AGAT. These sequences were clustered using Orthofinder. The hmmsearch function from Hmmer was used to identify TIR domains (PF01582) present. IQ-Tree 2 was used to construct a Maximum-likelihood Tree from domain sequences. The tree was divided into adapter-like domains and SARM1-like domains, identifying multiple possible TLR adapters. Future experiments can investigate the function of these proteins, providing further insights about Echinoderm immune signaling.

Title: Evaluation of Six Lipid Extraction Methods for Ion Mobility Mass Spectrometry-based analysis of *Escherichia coli*

Primary Author: Kristen Marshall

Additional Authors: Ahmed Hamid;Md Naymor Rahaman;Iffat Jerin;Adebowale Oyerinde;

Mentor: Ahmed Hamid

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Understanding bacterial lipids as signaling molecules and accurately characterizing them depends on the use of effective and representative extraction solvents. Numerous solvent systems have been found efficient for lipid extraction by different researchers, but no comprehensive evaluation of their effectiveness across multiple lipid classes has yet been conducted. To evaluate various lipid extraction methods, a comparative analysis of the lipid composition of *Escherichia coli* O16:K1(L): NM was performed, including six different extraction techniques. These techniques include the Bligh and Dyer method, 1-Butanol/methanol single-phase method, MAW single-phase method, MTBE method, Folch method, and SPE method. Bacteria were cultured in LB medium for 16 hours at 37 °C, and cells were counted for standardization and analyzed by liquid chromatography–tandem mass spectrometry using high-resolution positive- and negative-mode electrospray ionization. This presentation showed that more than 92 distinct lipid species across seven lipid subclasses were identified in our bacterial lipid library. LC–MS/MS data provide insight into the effectiveness of extraction techniques based on peak intensities, the number of lipids identified using the lipid library, and the diversity of lipid classes recovered. This comprehensive study provides guidance for selecting the most suitable solvent system for profiling specific lipid classes.

Title: “You have to meet people where they are”: A narrative inquiry of trust and institutional navigation in forestry assistance

Primary Author: Kristin Wortham

Additional Authors: Allie McCreary;

Mentor: Allie McCreary

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Forestry assistance programs are intended to promote sustainable forest management among small private landowners. However, disparities in participation limit their effectiveness, particularly for historically underserved populations. Existing research has largely emphasized landowner motivations and barriers while giving comparatively little attention to the perspectives of the institutional actors responsible for delivering these programs. This study utilized semi-structured interviews with agency personnel (n = 7) representing conservation agencies and organizations to examine how forestry assistance professionals interpret the challenges and opportunities associated with engaging forest landowners. Specifically, data gathering occurred with personnel working across Alabama, Georgia, and South Carolina, and interviews were prompted for feedback on organizational engagement with heirs’ property owners and other marginalized groups. Interview recordings were transcribed verbatim and analyzed by using a narrative inquiry methodological approach to examine how agency personnel construct and interpret landowner engagement. The Sustainable Livelihoods Framework was applied as a theoretical lens to interpret the factors shaping participation. Findings indicate that practitioners consistently frame effective engagement as relational and trust-dependent. Participants described their roles as boundary-spanning intermediaries who translate bureaucratic systems for landowners while navigating institutional expectations and requirements. Personnel are constrained by administrative and other limitations and also report that cross-agency collaboration and other strategies can be used to overcome these challenges. This study shifts attention from individual landowner decision-making to the institutional and relational conditions that impact landowners’ access to technical assistance programs. The findings support the need for relationship-centered and context-sensitive engagement models that align institutional practices with the lived realities of small-scale and historically marginalized forest landowners across the U.S. South.

Title: Spatio-temporal coordination of virulence, metabolism, and stress responses shapes infection dynamics of *Xanthomonas perforans*

Primary Author: Kylie Weis

Additional Authors: Palash Ghosh; Amanpreet Kaur;

Mentor: Neha Potnis

Department/Program: Plant Pathology

College: College of Agriculture

Abstract: Plants provide distinct ecological niches for diverse microbial communities, with each member adopting strategies tailored to the specific ecological niche it inhabits. Two foliar niches, the leaf surface (epiphytic environment) and the leaf interior (apoplastic environment), impose distinct physiological constraints on microbial fitness, particularly for hemibiotrophic pathogens. In this study, we investigated how these environments shape the transcriptional responses of *Xanthomonas perforans* (Xp), a tomato pathogen, and how its virulence factors, metabolic pathways, and regulatory networks are spatially and temporally coordinated during disease progression. Transcriptome profiling of a pathogen recovered from the leaf surface and apoplast revealed pronounced niche-specific and colonization stage-specific gene expression patterns. Early epiphytic colonization was characterized by activation of chemosensing, and motility pathways that facilitate pathogen relocation and acquisition of limiting nutrients such as iron and phosphate. This stage also featured induction of DNA and protein repair systems, quorum sensing pathways, phenylalanine degradation and tyrosine conversion to counter phenylpropanoid defenses, genes involved in mitigating osmotic and oxidative stress, active DNA exchange machinery, and type VI secretion system-mediated microbial competition. Upon entry into the apoplast, Xp shifted toward active metabolism and replication, accompanied by investment in type II and III secreted virulence factor expression. Genes involved in evasion of plant immunity and overcoming of host-mediated nutrient sequestration were also upregulated, including those involved in quinone detoxification, phosphate and sulfur uptake, and fatty acid, xanthan, and LPS biosynthesis. During late apoplastic colonization, the pathogen transitioned again towards strong stress response activation, followed by renewed expression of flagellar motility and chemotaxis genes, suggesting preparation for dissemination. Notably, genes associated with oxidative and nutrient stress were enriched across both niches, although specific components differed. Type IV pili, conjugation genes, and plasmid-borne type III effectors were induced early in both niches, suggesting their niche-independent role in initial establishment. Together, these findings reveal a coordinated spatio-temporal regulatory strategy during the transition from the leaf surface to the apoplast.

Title: The effect of temperature extremes on oxidative damage in juvenile pinfish (*Lagodon rhomboides*)

Primary Author: Lane Dominy

Additional Authors: Abby Bednarski;

Mentor: Moises Antonio Bernal de Leon

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Marine ectotherms depend on environmental temperature for physiological processes. When experiencing extreme temperatures, mitochondrial function is negatively impacted, thus leading to the generation of reactive oxygen species (ROS). These ROS can damage proteins, causing oxidative stress and tissue damage. The pinfish (*Lagodon rhomboides*) is one of the most prevalent marine fish species along the Atlantic Coast, playing a vital role in marine ecosystems. Despite their ecological importance, limited information exists on how they respond to thermal extremes. This study examines how temperature extremes produce oxidative damage in pinfish liver tissue, by measuring protein carbonyl concentrations— a marker of ROS-induced protein damage. Individuals were collected from Dauphin Island, Alabama and acclimated to average summer temperatures (23°C) for 22 days before being randomly assigned to three treatment groups: control (23.5°C), warming (29°C), and cooling (19°C). On the 58th day of treatment, individuals were euthanized and oxidative damage was measured using an ELISA assay. Heat-stressed pinfish showed significantly lower protein carbonyl concentrations compared to control groups (0.793 nmol/mg, $p=0.037$). This contradicts the hypothesis that seasonal temperature extremes would increase oxidative damage. No significant differences were found between control and low temperature groups (0.249 nmol/mg, $p=0.476$) or between heat and low temperature groups (0.544 nmol/mg, $p=0.104$). These unexpected results suggest that pinfish may possess high physiological plasticity, allowing them to acclimate and ameliorate ROS effects, or that more extreme temperatures beyond seasonal averages are required to elicit oxidative damage. Future research should re-evaluate critical thermal thresholds and examine additional oxidative stress markers to better understand stress response mechanisms in this ecologically important coastal species.

Title: Limited food availability and gastrointestinal plasticity in wild-derived house mice, *Mus musculus*

Primary Author: Lauren Cacciatore

Additional Authors: Charlie Scharnatta;Rex Usry;Sophie Mae Talbert;Lorraine Potter;Olivia Nichols;Olivia Moore;Ava Murren;Catey Lukasz;Molly Chandler;Kelley Bush;

Mentor: Wendy Hood

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The gastrointestinal tract is highly plastic and can change in size and morphology in response to varying energy demand and food availability. Previous studies examining the effects of fasting on gastrointestinal plasticity have primarily focused on single, acute fasting events. Here, we extend this literature by evaluating responses to repeated intermittent fasting. We predicted that fasting would reduce overall gut length and diameter, that modest fasting would increase villus length, and extended fasting periods would decrease villus length. Increased villus length during modest fasting is expected to reflect a compensatory mechanism that enhances digestibility. In contrast, decreased villus length during prolonged fasting is consistent with a reduced capacity to sustain tissue anabolism. This experiment used adult, wild-derived house mice (*Mus musculus*) as a model. Males and female mice were divided equally into three treatment groups: a control group with ad lib food (n=9), a 24-hr fed/24-hr fasted group (n=10), and a 36-hr fed/36-hr fasted group (n=11). Feeding regimes were maintained for 19 days before euthanasia. After death, the body mass was measured, and the digestive tract was removed. Total intestinal length, including the small intestine, large intestine, and cecum, was measured. Additionally, the intestinal width was measured. The small and large intestines were weighed. One-centimeter sections from the duodenum, jejunum, and ileum were collected and submitted for histological analysis. After the samples were returned, villus height was measured for six villi per section, when available. Our results revealed no significant difference between treatment groups in any measured variable. This suggests that wild-derived house mice undergoing intermittent fasts of up to 36 hours can compensate for fasting during subsequent refeeding; however, whether this compensatory capacity is maintained when longer/chronic fasting is introduced remains unknown.

Title: Developing adaptive menstrual underwear for women wheelchair users

Primary Author: Lauren Lansdell

Additional Authors: Jia Wu;

Mentor: Jia Wu

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Some women wheelchair users (WWUs) face challenges when managing their menstrual health because of mobility and dexterity limitations. Most of the menstrual products on the market today do not consider these needs, posing as a barrier for WWU, and affect them physically, mentally, and emotionally when managing their menstrual health. Therefore, the purpose of this four-phase study was (1) how to incorporate the user-centered design (UCD) approach to explore WWUs' need for adaptive menstrual underwear; (2) how menstrual underwear could be designed to meet those needs; and (3) how WWUs perceive the performance, comfort, and usability of the underwear. The clothing comfort model and person-environment-occupation-performance model were employed in this study. Phase 1 included a secondary data analysis from product reviews of adaptive underwear, period underwear, and reusable pads, resulting in 772 consumer reviews collected across 110 products. Phase 2 conducted semi-structured interviews with seven participants who have physical disabilities or caregivers, during which they identified their needs for adaptive menstrual underwear. Findings indicate WWUs need adaptive menstrual underwear that reduces pressure points and fabric bunching, breathable and absorbent fabrics, adaptive closures, addressing RQ1. In Phase 3, three adaptive menstrual underwear prototypes were developed based on the findings from the secondary data analysis and participant interviews. Design features include a low-front/high-back design, magnetic hook closures, and three-sizes of reusable absorbent pads, addressing RQ2. Finally, in Phase 4, all seven participants provided feedback based on a visual evaluation of the three prototypes. Participants suggest that the use of these prototypes would help reduce reliance on caregivers while enhancing self-confidence and independence, addressing RQ3. Future research is to test the participants' preferred adaptive menstrual underwear prototype.

Title: A Comparative Evaluation of Kalman and IMM Filters for Vehicle State Estimation

Primary Author: Lauren Mohler

Additional Authors: Blake Sandidge;

Mentor: Scott Martin

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Vehicle modeling and sensor fusion are central to autonomous ground vehicle navigation. Researchers use Vehicle models to support state estimation for navigation and control. Similarly, integrating Global Positioning System (GPS) measurements with Inertial Measurement Unit (IMU) data through algorithms such as the Kalman filter or the Interactive Multiple Model (IMM) filter helps maintain navigation integrity. While increased vehicle model and filter complexity can improve estimation robustness, these benefits often require higher computational power, thereby yielding increased implementation costs. This study evaluates the trade-offs associated with filter complexity under a simplified vehicle model to assess whether the increased computational load of an IMM filter yields meaningful performance gains over a single Kalman filter in low-dynamic ground vehicle applications. The two-degree-of-freedom (2-DOF) vehicle model focuses on two critical states (lateral velocity and yaw rate), and the IMM filter enables vehicle mode-switching to account for time-varying dynamics arising from changes in maneuvering conditions. We simulated the filtering approaches in MATLAB with pseudo-IMU and GPS data, then experimentally validated using a ground vehicle through Auburn University's GPS and Vehicle Dynamics Lab (GAVLAB). While the 2-DOF vehicle model provided sufficient fidelity, the results show minimal performance gains from the IMM filter relative to the single Kalman filter. These findings suggest that the added complexity of a more advanced filter is better suited for systems exhibiting higher dynamic behavior, such as hypersonic vehicles.

Title: Nursing Your Nerves

Primary Author: Lauren Trombino

Additional Authors: Christine Feeley;Kendall Henderson;

Mentor: Kendall Henderson

Department/Program: Nursing

College: College of Nursing

Abstract: Testing stress is a common challenge faced by nursing students due to the rigorous design of the exams that test students' clinical judgement skills. Students may utilize positive or negative coping mechanisms to reduce their testing stress. Recognizing how coping mechanisms affect students testing stress levels will give us important information to improve students well-being. Understanding how testing stress relates to exam outcomes is important for success in nursing programs. The purpose of this study was to examine the relationship between coping mechanisms, student test stress levels, and exam performance in Auburn University Undergraduate nursing students. This project utilized a quantitative, correlational design. Auburn Undergraduate nursing students completed an anonymous, nonidentifiable qualtrics survey after the completion of a nursing exam. The questionnaire included reporting coping mechanisms, the cognitive test anxiety scale, and self reporting of exam scores. Correlational analysis was conducted to examine relationships between stress levels, coping mechanisms, and exam scores. Increased test stress levels did not show significance associated with exam performance. However, higher test stress scores did reflect a statistically significant relationship with negative coping mechanisms, with negative self talk and procrastination being the strongest correlation. Positive coping mechanisms showed no statistical significance in lower stress scores. In conclusion, high levels of testing stress were associated with the use of negative coping mechanisms. These findings suggest that students' coping mechanisms do not affect exam scores, but affect their psychological stress. Interventions should focus on strategies to decrease negative coping mechanisms to improve student well-being.

Title: Differential Effects of Social Exclusion on Internalized and Externalized Emotion

Primary Author: Leah Jha

Additional Authors: Hannah Oliver; Paxton Bryan; Abi House; Parker Jones; Andrew So; Oliver Gustafson; Emma Truchan;

Mentor: Travis Evans

Department/Program: Psychology

College: College of Liberal Arts

Abstract: As a social species, humans are highly sensitive to being socially excluded or included by other individuals. As such, social exclusion robustly elicits negative emotional responses and dampens positive emotional responses. Notably, however, emotional responses can be directed either towards oneself (internalized) or directed towards other individuals (externalized). In the context of negative emotional responses, for example, individuals can “feel bad” about themselves (internalized) or “feel unfriendly” towards other individuals (externalized). However, no research to date has examined if social exclusion differentially elicits internalized or externalized emotional responses. Accordingly, this study examined whether social exclusion, compared to a social inclusion control condition, elicits differences in the degree to which negative and positive emotional responses were internalized or externalized. For negative emotion, participants exhibited similar increases in both internalized and externalized negative emotion following social exclusion ($p < 0.001$). In contrast, participants exhibited significantly stronger decreases in internalized positive emotion ($p < 0.001$) compared to externalized positive emotion ($p = 0.05$). Overall, these findings demonstrate differences in the degree to which emotional responses are directed towards oneself or others following social exclusion, which can provide a better understanding of how emotions shape social behavior in response to social exclusion. In addition to offering broader implications for understanding social behavior, these findings may ultimately be useful towards developing interventions for individuals experiencing chronic social exclusion, which is an important area for future research.

Title: Simulating the impact of hidden founder relatedness on pedigree-based inbreeding estimates

Primary Author: Lee Ann Bailey

Additional Authors: Janna Willoughby;

Mentor: Janna Willoughby

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Understanding the history and consequences of inbreeding is important for conservation and management. One tool for quantifying inbreeding is a pedigree, which tracks how individuals are related and reproduce over generations. Pedigree-based estimates of inbreeding can be biased when you do not know how related initial pedigree founders are. Here, we quantified how hidden founder relatedness biases inbreeding estimates by simulating pedigrees with varying founder-kinship structures and statistically testing the magnitude and timing of underestimation. We hypothesized that increasing hidden relatedness among founders increased the downward bias in estimated inbreeding coefficients when founder relationships are ignored. Our results show that across all scenarios, there was a consistent increase in the magnitude of the downwards bias in estimated inbreeding coefficients when founders were assumed to be unrelated. We next hypothesized that more complex forms of hidden founder relatedness would generate greater inbreeding estimation bias than simpler structures, even when the total founder number is constant. Our results showed that, regardless of the structure of the simulation, the magnitude of underestimation was directly correlated with total founder kinship. Finally, we hypothesized that bias underestimation would peak in early generations and then stabilize or decline as the pedigree grew. Our results showed that bias was strongest in early generations and became more stable in later generations. Pedigrees with little to no known information on the founders can provide bias in inbreeding estimates. Pedigree truncation in these scenarios leads to predictable and substantial underestimation in early generations. When working with populations that have unknown founder relationships, it is important to consider genetic monitoring, careful population founding or reintroduction strategies, and potential genetic rescue to support conservation of natural populations.

Title: Identifying cultural and chemical controls to manage *Tropilaelaps* mites in honey bee colonies

Primary Author: Lena Barascou

Additional Authors: Dan Aurell;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: *Tropilaelaps mercedesae* is an emerging global parasitic threat to western honey bees, *Apis mellifera*, due to its rapid reproduction, feeding on brood (developing bees), and transmission of viruses. This research evaluated practical cultural and chemical interventions for *T. mercedesae* control under tropical field conditions in Thailand. Brood frames were removed to induce a broodless period intended to interrupt mite reproduction, and a single formic acid pad (FormicPro™) was applied. These interventions applied on their own and in combination created the following treatment groups: (1) Brood Break; (2) Formic Acid (3) Brood Break + Formic Acid; and (4) Untreated Control. Following the 21-day treatment period, a clean-up treatment was applied to all colonies consisting of queen caging for 24 days followed by oxalic acid application to eliminate remaining mites. *Tropilaelaps* infestation levels were assessed on Days 0, 4 and 21 to by uncapping and examining 200 worker brood cells per colony. Mite fall was monitored every three days throughout the experiment using bottom-board sticky boards. Colony strength and condition, including adult bee population, capped worker brood, and food resources, were evaluated through visual inspections on Days 0, 21 and 45. Post-treatment results (Day 21) indicate higher *Tropilaelaps* infestation in Untreated Colonies (2.84%) compared to the Brood Break (0%), Brood Break + Formic Acid (0.05%) and Formic Acid (0.07%) groups. Interestingly, 4 days after formic acid application, all mites found in brood cells were dead; whereas all mite in the control colonies were alive, which explains the mechanism of action. Lower populations of adult honeybees and worker brood were observed in Brood Break and Brood Break + Formic Acid colonies compared to Control and FA colonies on Day 21. Even if not all mites are eliminated in all treatment groups, these findings support brood interruption and formic acid treatment as effective strategies for *Tropilaelaps* control.

Title: Random Search Matches Evolutionary Optimization for MoE Topology: Evidence of a Flat Fitness Landscape

Primary Author: Libo Sun

Additional Authors: Xiao Qin; Peixiong He;

Mentor: Xiao Qin

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Mixture-of-Experts (MoE) architectures create vast combinatorial search spaces for topology optimization---with N experts yielding 2^{N^2} possible communication patterns, evolutionary algorithms (EAs) appear well-suited for this discrete optimization challenge. But does EA-guided search actually outperform random sampling? We address this question through compute-matched experiments comparing a genetic algorithm against random search, both given identical evaluation budgets (EA: 1,881; Random: 1,928 fitness evaluations) across six random seeds. Our central finding is negative: random search matches or exceeds EA performance. Random search achieves lower perplexity in 4 of 6 seeds (67\%), with a medium effect size (Cohen's $d = 0.66$) favoring random search. This result is robust across mutation rates spanning two orders of magnitude (0.5\%--100\%) and holds for both complex and simplified EA designs. We identify the mechanism underlying EA failure: the MoE topology fitness landscape appears essentially flat. Population analysis reveals *\emph{structural convergence without fitness improvement}*---edge diversity collapses 64\% while perplexity variance remains stable. On flat landscapes, selection pressure provides no gradient to exploit, and EA degenerates to random search with an additional concentration effect that may hurt performance.

Title: Postharvest evaluation of six strawberry cultivars for Alabama production

Primary Author: Lillee Lombardo

Additional Authors: Marlee Trandel;

Mentor: Marlee Trandel

Department/Program: Horticulture

College: College of Agriculture

Abstract: Over the past decade, 'Camarosa' has dominated strawberry production in Alabama, yet increasing disease pressure has limited the availability of replacements with comparable postharvest qualities. This study selected 6 cultivars from University of Florida ('Felicity') and University of California Davis ('Royal Royce', 'Fronteras', 'Mojo', 'Golden Gate', 'Valiant'). Fruit was grown in a complete randomized block design and harvested at the E.V. Smith Research Center. Fruit was transported to the postharvest laboratory, sorted, and held at 4 °C and 85% relative humidity for 9 days. Postharvest data was collected at days 0, 3, 6, and 9 in storage. Non-destructive measurements included individual berry weight (g, at day 0 only), % weight loss (g), and color (L^* , a^* , b^* , chroma, and hue). Destructive measurements were tissue firmness (N) and general composition (SSC [°Brix], titratable acidity, and pH). This was followed by phytonutrient assays for total anthocyanins (mg/g), total phenolics (mg/100g), and total antioxidant activity (mM/100g). 'Valiant' and 'Royal Royce' (31.9 g and 28.4 g) had the largest individual fruit, and 'Golden Gate' had the smallest (22.4 g). Enhanced color attributes were shown by 'Felicity' and 'Valiant'. By day 6, all cultivars crossed 6% weight loss, which is considered the marketability threshold. 'Golden Gate' had the highest percentage weight loss (4.14%), and 'Royal Royce' was the lowest (3.51%). Firmness decreased by 3 N for all cultivars during storage, with 'Mojo' having the highest (11.92 N), and 'Fronteras' the lowest (8.97 N). 'Mojo' also had premium SSC content (9.87 °Brix). There were significant cultivar*storage timepoint interactions seen in TA and pH and 'Felicity' had the highest TA. pH values varied across cultivars and storage timepoints. Although this study evaluated the postharvest performance of new cultivars, additional assessments of yield and disease resistance are required before definitive conclusions can be drawn.

Title: The role of interior design in supporting psychological readiness among baseball players

Primary Author: Lindsay Agena

Additional Authors:

Mentor: Anna Ruth Gatlin

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Baseball performance at the collegiate and professional levels relies not only on physical preparation but also psychological readiness, which is defined as an athlete's ability to achieve optimal focus, emotional regulation, and mental preparedness prior to competition. However, current clubhouse and stadium layouts often prioritize efficiency over supporting players' mental transition from private preparation spaces to high intensity performance environments. As a result, players are often forced to move abruptly from low stimulating locker rooms to high stimulating field conditions without the proper support for player focus and emotional regulation. Research shows incorporating biophilic design elements, such as natural lighting and greenery, can reduce stress and improve cognitive function benefiting the athlete. Integrating intentional space planning strategies can create transitional environments that support players' mental preparedness and performance on the field. The purpose of this research is to explore interior design strategies that support player psychological readiness with a focus on the transition space between locker room and dugout and dugout and field. Outcomes include the development of prototypical locker room, dugout, and field designs that incorporate gradual stimulation zones, greenery, and natural lighting which illustrates how integrated strategies can support psychological readiness as players enter competitive play.

Title: Rebuilding therapeutic balance: Gut microbiome dynamics and therapeutic opportunities in Wilson's Disease

Primary Author: Lindsey Eddleman

Additional Authors: Muralikrishnan Dhanasekaran;Suhrud Pathak;Keyi Liu;Josh Deutschendorf;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Pathogenic mutations in the ATP7B gene cause Wilson's disease (WD), an autosomal recessive disease that leads to progressive neurological and hepatic damage, as well as toxic copper buildup. Although zinc treatment and copper chelation lower the systemic copper load, both are nevertheless effective in reversing tissue damage or chronic neuroinflammation. Gut microbiome dysregulation plays a role in WD pathogenesis, and microbiome-targeted therapies can serve as a promising supplementary therapeutic approach has not been well established, were the primary research objectives driving this study. The evidence from high-throughput sequencing studies, metabolomic profiling of WD patients, mechanistic studies in ATP7B knockout mouse models, and comparative data from microbiome-based therapies in related metabolic and liver disorders were all obtained in an organized PubMed, Google Scholar, and Scopus literature search. Reduced microbial diversity, depletion of taxa that produce short-chain fatty acids, enrichment of species that are resistant to copper, compromised intestinal barrier integrity, and increased systemic inflammation along the gut-liver-brain axis are all consistently linked to WD, according to the research. These results imply that excess intestinal copper increases hepatic and neuroinflammatory damage and drives dysbiosis by exerting selective antimicrobial pressure. The findings correspond to the gut microbiota as a disease contributor in WD and a potential target for treatment; methods like fecal microbiota transplantation, defined microbial consortia, and targeted microbial restoration require additional translational research.

Title: The Alabama Youth Relationship Education project in practice

Primary Author: Lindsey Gump

Additional Authors:

Mentor: lmt0045

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Residents of Alabama have a history of family instability that can place youth at risk for developing unhealthy romantic relationships. Alabama adolescents experience higher rates of risky sexual behaviors and victimization, including physical dating violence. The Alabama Youth Relationship Education (AYRE) Project aims to address these concerns by teaching youth about healthy relationships and, in the long term, strengthening marriage and parenting skills. AYRE accomplishes this by providing adolescents with relationship education and accessible resources. During the spring and fall semesters of 2025, the author worked with AYRE in an undergraduate service-learning capacity. This presentation will highlight the author's experiences with the project and impressions of how research can be translated into real-world practice. The author's experience with AYRE underscored the importance of highlighting the link between healthy relationships and overall well-being. Throughout the project, the author learned to pay particular attention to parent-adolescent relationships, recognizing how vital they are during this developmental period. A key goal was to provide each participant with a meaningful experience by demonstrating how strong communication and relationship skills can improve their own lives and positively impact the people around them.

Title: Adrenal gland gene expression in mice is differentially altered by oral and injected thyroid hormone

Primary Author: Lindsey Weiden

Additional Authors: Jeff Huang; Yuan Kang;

Mentor: Jeff Huang

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Thyroid hormone therapy can be administered via injection or oral delivery. The effects of this therapy, particularly at the level of the administration route on the adrenal gland transcriptome, remain unclear. To address this, we used mouse models to investigate transcriptional changes in the adrenal glands of male and female mice subjected to thyroid hormone injection or oral administration. Mice were given triiodothyronine (T3) through drinking water (0.5 µg/mL) or a daily subcutaneous injection (1 µg per mouse in saline), starting at 25 days postnatal. At 35 days postnatal, the mice were sacrificed, and their adrenal glands were gathered for PE150 RNA-seq analysis. Differentially expressed genes (DEGs) were identified using DESeq2 in R, applying a threshold of at least two-fold change and adjusted $P < 0.05$. Genes with fragments per kilobase of transcript per million mapped reads (FPKM) greater than 5 in at least one sample were considered adrenal-expressed and included in the DEG analysis. Principle component analysis of the RNA-seq data revealed clustering by both sex and treatment group. The number of DEGs increased by approximately 2.4-fold in females and 2.9-fold in males following oral administration compared to injection, suggesting a stronger effect via the oral route. Gene Ontology enrichment analysis supported these findings, identifying distinct functional categories of altered genes between the two administration routes. T3 treatment mainly affected gene expression, with a greater number of genes upregulated than downregulated. Among T3-responsive genes shared between sexes, oral administration caused greater fold changes. While dosage in oral administration varies due to differences in water consumption, this study provides the first evidence that orally administered thyroid hormone can apply route-dependent effects on the adrenal gland transcriptome, producing effects that are more powerful and widespread than those observed with injection.

Title: Comparison of *Aedes aegypti* blood and sucrose feeding behaviors using Electropenetrography (EPG)

Primary Author: Logan Bare

Additional Authors: Anastasia Cooper;

Mentor: Kathryn Reif

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Mosquito feeding behaviors may directly affect pathogen transmission, vector competence, and reproductive success. However, the difference in probing and ingestion behaviors related to blood and sucrose feeding are relatively unexplored. The mechanisms by which *Aedes aegypti* female mosquitoes ingest different food substrates were explored using electropenetrography (EPG) to indirectly visualize and quantify penetration, ingestion, resting, and withdrawal during feeding on artificial blood and sucrose feeders by measuring electrical signals, called waveforms, that correlated with each behavior. Statistical analysis of five common EPG parameters using Insect Feeding Behavioral Statistics (INFEST) revealed that mosquitoes probed more often, sooner, and for longer on blood than on sucrose. In addition, mosquitoes spent more time during the probes resting and not ingesting while their mouthparts were in the sucrose-drenched cotton than in the artificial membrane blood feeder. Furthermore, comparisons of peak frequency during ingestion waveforms indicated that pumping may be stronger when drinking blood than when drinking sucrose. This supports the idea that more effort is required to draw blood through a membrane than to drink sucrose from cotton. Overall, these findings show that EPG can detect changes in probing and ingestion mechanics across different substrates and establish a methodology for further investigation of mosquito feeding behaviors on more realistic host substrates.

Title: SketchVLM: Drawing Before Thinking Boosts Multi-modal Reasoning

Primary Author: Logan Bolton

Additional Authors: Hung Nguyen; Brandon Collins;

Mentor: Anh Nguyen

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Vision language models (VLMs) such as Gemini-2.5 and GPT-5 demonstrate impressive general reasoning capabilities, but they can struggle with spatial grounding, explainability, and user controllability. We present SketchVLM, a training-free framework (on top of Gemini 2.5 Pro or GPT-5) that enables multimodal models to "reason through sketches" drawn as overlays on top of the input image. Our approach externalizes reasoning steps as explicit, interpretable sketches that can be viewed and edited by humans. Compared to the no drawing (baseline), drawing improves the accuracy of the VLM across three visual reasoning tasks: (1) maze navigation, (2) predicting ball drop trajectories, and (3) counting while providing the visual traces of how the model visualizes the trajectories or labels the counted objects. On three drawing tasks of (1) labeling parts of an object, (2) connecting dots, and (3) drawing shapes around objects, SketchVLM outperform the baselines of GPT-5, Gemini 2.5 Pro (without our prompt step), Nano Banana and Qwen 3 VL. SketchVLM outperforms three state-of-the-art general VLMs (Gemini-2.5-Pro, Gemini-2.5-Flash, and GPT-5) without additional training or fine-tuning. In sum, we explore a promising direction of letting VLMs sketch out the visual thinking traces (labels of objects, trajectories, annotations) on the input image which improve VLM accuracy and provide an explanation that is otherwise hard to express in text (e.g., it is harder to express a trajectory in natural language and in drawing).

Title: Model-Free Iterative Learning Control Implementation for Quadrotors following Minimum-Snap Optimized Trajectories

Primary Author: Logan Phillips

Additional Authors: Jack Kovryzhenko;Ehsan Taheri;

Mentor: Ehsan Taheri

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: The Global Drone Market Report forecasts that the global market for drones will reach a value of \$57.8 billion by 2030, with major industry applications including energy and warehousing. As the overall industry for drones grows, ensuring efficient usage and sufficient performance of drones is a major concern. Modern implementations of learning algorithms, such as Iterative Learning Control (ILC), have seen success in industrial systems with repeated processes. Since the growing applications of drones in the commercial and industrial sectors follow similar repeatable processes, this study aimed to investigate the performance gain achieved by implementing a model-free ILC as opposed to reliance on standard model-based control methods. A minimum-snap optimized trajectory was solved and was used as the primary path for simulation. Only one drone was used with known mass properties. The values for the learning gains were varied to infer trends in the error convergence with the number of iterations. The implementation saw improvement in the reduction of control error over standard control methods, with the position error being reduced by a factor of two. The considered form of ILC proves to be an adequate choice for improving the performance of systems such as quadrotors that perform repeated tasks, but like other control algorithms, it requires effective tuning of the learning gains to reach the desired error convergence. This indicates that for large-scale applications of drones, model-free ILC has the potential to improve the drone's performance with minimal cost to set up, but its parameters must be tuned judiciously.

Title: Preventive Strategies for Pediatric Oral Health

Primary Author: Loryn Allen

Additional Authors: Linda Gibson-Young;

Mentor: Linda Gibson-Young

Department/Program: Department of Medical and Clinical Lab Sciences

College: College of Nursing

Abstract: Dental caries is one of the most prevalent chronic conditions among children, affecting approximately 45% of U.S. children aged 2–19 years, according to data from the Centers for Disease Control and Prevention, yet it is largely preventable with early and effective interventions. This systematic review evaluated the effectiveness of school-based preventive strategies aimed at improving pediatric oral health outcomes. A structured literature search was conducted across PubMed, CINAHL, and Scopus for studies published between 2000 and 2024. Inclusion criteria comprised peer-reviewed randomized controlled trials, quasi-experimental studies, and systematic reviews examining school-based oral health programs targeting children aged 5–18 years. Studies focusing solely on clinical treatment without preventive components were excluded. A total of 32 studies met inclusion criteria. Findings indicate that multi-component school-based programs, including classroom oral health education, teacher-led instruction, fluoride varnish application, and dental sealant initiatives, demonstrated significant improvements in oral health knowledge and hygiene behaviors. Quantitatively, interventions reported plaque reduction ranging from 15–35%, gingival inflammation reductions of 10–25%, and caries incidence reductions between 20–40% compared to control groups, with most studies reporting statistically significant outcomes ($p < 0.05$). Programs incorporating caregiver education showed additional improvements in children's brushing frequency and reduced untreated decay rates. Study quality was assessed using standardized risk-of-bias tools, with most randomized controlled trials demonstrating low-to-moderate risk of bias. Overall, evidence supports comprehensive, school-based preventive strategies, particularly those integrating caregiver engagement, as effective, scalable public health interventions capable of significantly reducing the burden of pediatric dental disease and promoting long-term oral health outcomes.

Title: Comparisons of medical and prescription drug costs between Americans who used insulin glargine Lantus and its interchangeable biosimilar Semglee

Primary Author: Lotanna Ezeja

Additional Authors: Jingjing Qian;

Mentor: Jingjing Qian

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Semglee (insulin glargine-yfgh) was approved as an interchangeable biosimilar to the reference product Lantus (insulin glargine) on July 28, 2021 in the U.S. This study compared annual medical and prescription drug expenditures between individuals who used Lantus and Semglee in a nationally representative sample. Medical Expenditure Panel Survey data (2021-2023) was used to identify individuals with prescription fills for either Lantus or Semglee. The proportions of individual's age, sex, race/ethnicity, geographic region, education, income, and insurance status were compared between Lantus and Semglee users using Rao-Scott Chi-square test. Annual total and out-of-pocket (OOP) medical and prescription drug expenditures (limited to Lantus/Semglee) were adjusted to 2023 U.S. dollars using the Personal Health Care and Consumer Price Indices and compared between the two user groups (least squares means). All analyses were weighted, and statistical significance was set at $P < 0.05$. There were 735 Lantus (weighted $n=2,495,364$) and 38 Semglee (weighted $n=177,531$) users in the sample. Lantus users had lower income levels than Semglee users ($P=0.006$). Most Semglee users had private insurance (70.7% vs. 41.3% for Lantus users). Lantus users had a higher mean annual total medical expenditure (\$26,943 vs. \$24,610) but lower OOP (\$1,732 vs. \$3,701) than Semglee users ($P < 0.001$). Lantus users had a higher mean annual total prescription drug expenditure (\$2,835 vs. \$1,475) and OOP (\$204 vs. \$121) than Semglee users ($P < 0.001$). Semglee led to lower total and OOP prescription drug expenditures for both healthcare system and consumers compared to Lantus, without increasing total medical expenditures. The higher OOP medical expenditures for Semglee users might be due to private insurance plan cost-sharing benefit design. Findings of this study call for real-world evidence research to compare effectiveness and safety between Lantus and its biosimilars for further adoption of biosimilars.

Title: Quantifying *Salmonella enterica* and *Escherichia coli* persistence in backyard environments

Primary Author: Luke Watters

Additional Authors: Kelsey McCune; Alex Fisher; LeeAnn Bailey;

Mentor: Kelsey McCune

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Human interactions with wildlife have increased zoonotic disease risk, particularly in backyards with bird feeders and chicken coops. These practices may create high-risk transmission points for pathogens by increasing the chances of contact between humans, wildlife, and additional vectors. This study evaluated backyard bird feeders and chicken coops as novel contact zones between disease vectors, reservoirs, and hosts, specifically in the persistence of *Salmonella enterica* and *Escherichia coli*. To assess this, we created 12 study sites, categorized based on their interaction types: bird feeder, chicken coop, bird feeder and chicken coop, and control. From each site, we collected a biweekly soil sample and used culturing techniques to test for pathogen presence. We also used a CO₂-baited trap to collect mosquito samples across two time points to investigate connections between pathogen presence and mosquito genera. Almost all soil samples contained *E. coli*, so we only compared the presence of *S. enterica* across sites. However, the data suggests that there is no significant difference in the probability of pathogen presence in the different study site conditions. The probability of mosquito genera was also found to be not significantly different based on the study site conditions; however, the presence of mosquitoes was lower at bird feeder and chicken coop sites compared to the other sites. While no significant results were found, this project shows the complexity of zoonotic diseases and the importance of continued research to reduce and better predict future health risks.

Title: Doubling up on healthy eating: Evaluation of a healthy incentive program and fruit and vegetable consumption

Primary Author: Maci Higgins

Additional Authors: Alicia Powers;Kara Newby;Vikas Mishra;

Mentor: Vikas Mishra

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Americans from low-income households often buy fewer fruits and vegetables than those from high-income households and face a higher risk of diet-related chronic diseases. To increase produce consumption among low-income households, the Double Up Food Bucks (DUFb) Alabama, a program supported by the United States Department of Agriculture-Gus Schumacher Nutrition Incentive Program (GusNIP) initiative, matches produce purchases for those participating in Supplemental Nutrition Assistance Program (SNAP) -up to \$40 at farmers markets and up to \$10 at grocery stores. This program operates by partnering with select Alabama grocery stores and farmers' markets in seven counties. This study aims to examine how DUFb has helped low-income SNAP households access more fruit and vegetables. We focus on two questions: (i) how much of the available incentives participants have redeemed and (ii) how the program has influenced fruit and vegetable consumption. To answer the first question, we use four years of transactional-level data on fruit and vegetable purchases by SNAP households at grocery stores and farmers' markets. Specifically, the incentives redeemed by SNAP households are summarized to measure the uptake of the program. Then, we compare incentives redeemed at farmers' markets and grocery stores. For the second question, we use four waves of survey data collected as part of a marketing campaign to SNAP households in the counties where DUFb operates. It provides information on the participation of SNAP households in the DUFb program, food security, and the frequency of fruit and vegetable consumption. We compare participants' produce consumption with that of nonparticipants. We expect that participants' redemption of incentives has increased over the program years, and DUFb has improved the fruit and vegetable consumption of participating households.

Title: Sex-dependent transcriptional changes in the adrenal gland following chronic alcohol exposure in mice

Primary Author: Madison Alworth

Additional Authors: Jeff Huang;Paul Thomes;Yuan Kang;Ahmed Bakheet;Murugadas Anbazhagan;

Mentor: Jeff Huang

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Alcohol consumption produces widespread physiological effects, yet research has primarily focused on organs involved in alcohol metabolism, particularly the liver, or on regulation of the hypothalamic–pituitary axis. Far less is known about alcohol’s impact on peripheral endocrine organs such as the adrenal gland. To address this gap, we investigated transcriptional changes in adrenal glands of male and female mice following chronic binge ethanol exposure. Twelve-week-old C57BL/6J mice were pair-fed an isocaloric Lieber–DeCarli liquid diet containing either 5% ethanol or a control diet for 10 days, followed by a single ethanol or maltose-dextrin gavage. Adrenal glands were collected 9 hours post-gavage and analyzed using paired-end RNA sequencing, with differential expression defined as a ≥ 2 -fold change and adjusted p-value < 0.05 . Principal component analysis revealed clear separation by sex and treatment, with strong reproducibility among replicates. Female mice exhibited a markedly greater transcriptional response to ethanol, showing more than threefold the number of differentially expressed genes compared to males. Limited overlap between sexes indicated distinct patterns of gene regulation, which were further supported by sex-specific Gene Ontology pathway enrichment. Several transcription factors associated with steroidogenic processes were down regulated following ethanol exposure, particularly in females. Overall, these findings demonstrate that chronic binge alcohol consumption induces significant, sex-dependent transcriptional alterations in the adrenal gland, warranting further investigation into their potential role in hormonal dysregulation.

Title: Unpacking unpredictability: Individual donor choices in food bank supply chains

Primary Author: Madison Edwards

Additional Authors: LaDonna Thornton;

Mentor: LaDonna Thornton

Department/Program: Supply Chain Management

College: Harbert College of Business

Abstract: Food pantries operate in supply chains where the composition and reliability of inventory depend on the unpredictable decisions of individual donors. Gaining a deeper understanding of these behaviors is important for operational efficiency and for finding ways food banks can better meet their communities' needs. In this study, the focus is on how individual donations affect supply chain outcomes from a behavioral operations management perspective. Participants are offered several occasions to donate some of an unexpected money reward to a virtual food bank. Various types of food items are suggested in the studies, and some categories that arise include fresh produce and protein sources. The nature of this experimental design facilitates an understanding of patterns of donor choice and preference, as well as implications for supply chain reliability and nutritional value. Preliminary expectations suggest that individual donors will disproportionately favor certain categories, contributing to imbalances in item composition and increased variability in supply reliability. By linking individual-level decision-making to operational consequences, this research aims to provide insights into how donor behavior influences inventory composition and the overall effectiveness of donation-driven food pantry supply chains.

Title: “Where’s the doggy?” Exploring infants’ active engagement during caregiver-infant shared reading

Primary Author: Madison Gaillard

Additional Authors: Aisha Qazi; Jamie Gensbauer; Cynthia Frosch;

Mentor: Cynthia Frosch

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Shared book reading is a critical context for supporting early language and socioemotional development, yet most research has focused primarily on caregivers’ behaviors rather than on infants’ active contributions to shared reading interactions. This study examines how infants’ engagement behaviors, including visual attention, motor interaction with books (e.g., pointing to pictures), vocalizations, emotional expressions, and social responsiveness, relate to the frequency and quality of caregiver-infant shared book reading interactions. Data will be collected from approximately 200–250 families recruited through a community partner serving under-resourced families in Alabama. Caregivers of infants (age 4-15 months) will complete a survey assessing family demographic information (including socioeconomic status), infant characteristics and behaviors, and shared reading frequency, duration, and quality. Quantitative analyses will examine whether higher levels of infant engagement with books predict more frequent shared reading and higher quality shared reading interactions. This study will also explore how social and contextual factors such as socioeconomic status and family structure relate to families’ shared reading practices. This project aims to provide insight into the active role infants play in shared reading interactions and inform early intervention and family literacy programs that aim to promote developmentally supportive shared reading practices from birth.

Title: Good farmers, good practices: Growers' farm management decisions on conservation

Primary Author: Madison Harris

Additional Authors: Kelli Russell; Steve Brown; Eros Francisco; David Russell; Adam Rabinowitz; Brenda Ortiz;

Mentor: Kelli Russell

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Efficiency and land stewardship are central tenets of row crop production. While much is known about the production factors related to conservation and sustainability, less is known about Southeastern U.S. farmers' perspectives and decision-making related to conservation farm management practices. In this research, we explore farmers' motivations regarding farm management practices and their conceptualizations of conservation, efficiency, and how these factors intersect with being a good farmer. Grounded theory guides all facets of data generation and analysis for this research. Data collection is ongoing, and at the time of writing, I have conducted 17 of a planned 30+ interviews, 3 informant interviews, and the data for this paper comes from 8 hours of participant observation. My preliminary findings indicate that farmers are significantly more concerned with the profitability of their operation than with adopting new conservation practices. Conservation is viewed as a tool to improve their yields, not a moral obligation. While farmers indicate they believe they should be "good stewards of the land," they simultaneously state that "good farmers" are the farmers who are profitable, not farmers who are focused solely on conservation efforts.

Title: Does nose work training affect dog executive function and physical fitness in humans and dogs?

Primary Author: Madison Uhlhorn

Additional Authors: Heidi Kluess; Alexandra Neff;

Mentor: Heidi Kluess

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Among domesticated animals, dogs are physically and behaviorally diverse. While centuries of breeding for specific traits accounts for many of these differences, a myriad of factors influence variation in cognitive and physical abilities among individual dogs. Here, we investigated whether training for nose work-type sports affects dog executive function and physical fitness in both dogs and their human companions. There is very little research into dogs and people who participate in scent/nose sports; however, these sports were originally developed to mimic activities performed by working dogs and their handlers in jobs like search and rescue and detection (drugs, electronics, explosives, etc). Given the demands of such training, we hypothesized that dogs and people that participate in nose work would have higher physical fitness, and the dogs would have advanced executive function compared to those that do not do the sport. Twenty-six dogs and 17 human companions were recruited for this pilot study. Humans completed a questionnaire that included the Dog Executive Function Scale, information about dog training, and a 7-day physical activity recall. Humans and dogs performed a battery of fitness tests, and dogs completed two cognitive tests. We found that fitness scores did not differ between groups (nose work / non-nose work) in dogs or people, and nose work training associated with higher reported dog executive function scores (non-nose work: 70 ± 24 ; nose work: 87 ± 13 ; $p < 0.05$). Notably, more formal nose work training was associated with less “giving up” in an unsolvable task (no nose work: $49 \pm 26\%$; enrolled in nose work: $18 \pm 16\%$; Titled in nose work: $13 \pm 15\%$; $p < 0.05$ titled different from no nose work). These results suggest that dog training, in general, may improve dog executive function and persistence in a task.

Title: Using machine learning to predict stroke

Primary Author: Mai Ellington

Additional Authors:

Mentor: Mai Ellington

Department/Program: Department of Mathematics and Statistics

College: College of Sciences and Mathematics

Abstract: A stroke occurs when blood flow to a part of the brain is interrupted, resulting in a lack of oxygen and cell death. This can happen when a blood vessel ruptures or gets blocked by a clot. Stroke is the leading cause of disability in the United States, according to the American Heart Association. Most strokes are preventable, and many lifestyle choices and health conditions can affect one's risk of stroke. Given the disabling nature of strokes, an algorithm is needed to accurately and quickly determine which patients are likely to have a stroke to ensure preventive care is administered to patients at the highest risk of stroke. This analysis explores how gender, age, marriage status, work environment, and whether someone lives in an urban or rural environment impact their risk of stroke. The analysis also considered the impact of BMI, average blood glucose level, and whether or not one has hypertension or heart disease on one's stroke risk. Finally, random forest and logistic regression machine learning models were trained to predict the occurrence of a stroke.

Title: Effect of Clomiphene citrate exposure during maturation on gene expression in parthenogenetic porcine embryos.

Primary Author: Malia Neville

Additional Authors: Brooke Newell;

Mentor: Paul Dyce

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: The use of in vitro embryo production within the livestock industry has allowed for selection of superior genetics while decreasing generation length. A major contributor to inefficiencies during in vitro maturation (IVM) is the accumulation of reactive oxygen species (ROS). Exposure of porcine oocytes to Clomiphene citrate (CC), a selective estrogen receptor modulator, during IVM reduces ROS and alters genetic pathways. To determine the genetic effect of CC exposure during maturation on resulting parthenogenetic embryos, we collected embryos at 60 hours post activation. RNA was isolated from groups of parthenogenetic embryos generated from oocytes matured in the presence or absence of CC. Then, complementary DNA (cDNA) was synthesized. To explore the potential genetic effects of CC exposure, we compared the expression of the cell-to-cell communication gene Gap junction alpha-4 protein (GJA4); the early embryo developmental gene, Bone morphogenetic protein 15 (BMP15); and genes essential in fertilization, Zona pellucida glycoprotein 2 (ZP2) and Zona pellucida glycoprotein 3 (ZP3). There was no difference in the expression of GJA4 in the CC treated embryos when compared to the control embryos. ZP2 expression was found to be significantly ($P < 0.5$) lower in the CC treated embryos when compared to the control embryos. Similarly, ZP3 was discovered to be expressed significantly ($P < 0.5$) lower in the CC treated embryos when compared to the control embryos. BMP15 expression was unaffected in the CC treated embryos when compared to the control embryos. These results suggest that CC exposure during maturation alters the expression of selected genes that potentially influence embryo health. The genes significantly lowered by CC are reported to lead to failure of fertilization along with embryonic arrest. Therefore, further investigation into CC effects on genes linked to fertilization along with earlier embryonic development is warranted.

Title: Role of tomato cytokinin response factor 5 (SlCRF5) in regulating leaf senescence

Primary Author: Malsha Thejani T Wasala Mudiyansele

Additional Authors:

Mentor: Aaron Rashotte

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Leaf senescence is a highly regulated developmental process that determines leaf longevity, nutrient remobilization, and ultimately plant productivity. Cytokinin (CK) Response Factors (CRFs) are a subset of APETALA2/Ethylene Response Factor (AP2/ERF) superfamily transcription factors that are involved in regulating leaf development through the cytokinin signaling pathway. Multiple studies have been conducted on CRFs in the model plant *Arabidopsis thaliana*, particularly CRF5 and CRF6, in relation to leaf senescence. Eleven CRFs are identified in *Solanum lycopersicum* (tomato) among which SlCRF5 is the ortholog of *Arabidopsis* CRF5 and CRF6. These genes share roles in oxidative responses associated with CK regulation. However, the conserved role of SlCRF5 in regulating leaf senescence remains unclear. Therefore, the main objective of this study is to understand the role of SlCRF5 in regulating leaf senescence. 40-day-old SlCRF5-Antisense (AS) knock down lines were used for dark induced leaf senescence assay with and without CK treatment. Physiological parameters including photosystem II efficiency (Fv/Fm), chlorophyll content, ion leakage, DAB stain and anthocyanin measurements were taken. qRT-PCR was conducted for the senescence associated genes. Our results indicate that SlCRF5-AS lines exhibit lower Fv/Fm, chlorophyll content, suggesting impaired photosynthetic function. Additionally, increased ion leakage, anthocyanin accumulation and DAB staining indicate oxidative stress in antisense lines compared to controls, regardless of CK treatment. Together, these findings suggest that SlCRF5 plays a conserved and critical role in modulating cytokinin-mediated oxidative balance and delaying leaf senescence in tomato.

Title: Vortex Dynamics of Truncated Delta Wing

Primary Author: Manan Hemantbhai Patel

Additional Authors:

Mentor: Anwar Ahmed

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Wing rock, an induced oscillation about the longitudinal/rolling axis, is one of the most serious issues that can be encountered in a delta wing aircraft. This oscillation, once it occurs, often exponentially grows in intensity, rapidly developing into an unrecoverable flight condition, which results in the catastrophic loss of the aircraft and endangers the pilot's life. The danger of this flight condition is compounded by the dramatic loss of lift that occurs when the oscillation is induced. The specific type of oscillation observed in this phenomenon is scientifically classified as a limit cycle oscillation. While multiple factors contribute to this oscillation, the primary cause is rooted in the asymmetry that develops in the opposing streamwise vortices. A vortex is a mass of fluid that spins around a central axis, forming a powerful, whirling current (just like tornadoes). Within a particular range of speeds and Angle of Attack, one of the vortex breakdowns occurs earlier than the other, which results in asymmetry of vortices and leads to a self-sustaining loop of oscillating lift forces beneath the wing, resulting in wing rock. This vortex phenomenon has been well documented in earlier studies related to traditional pointed delta wing designs. The current study explores one of the possible solutions, to use a Truncated Tip Delta Wing, which helps vortices maintain their symmetry and hence preventing the induced oscillations. This design change was inspired by configurations emerging in hypersonic and high-fuel efficiency aircraft. However, exceptionally little research has been carried out on them. Dye flow visualisation was utilised to understand the vortex dynamics on truncated delta wings. The additional leading-edge vortex stimulated the merging of opposing streamwise vortices and aided in avoiding limit cycle oscillations. This new design bridged the gap by circumventing the wing rock to create safer future aircraft.

Title: Profit by Design: How AI personalization challenges fairness and transparency in hospitality pricing

Primary Author: Manh Duc Do

Additional Authors: Rojan Baniya;

Mentor: Rojan Baniya

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: The implementation of AI-driven personalized pricing has become more popular in various fields, notably in the airline industry and online grocery retailers, thus bringing the conflict between revenue maximization and consumer perceived price fairness. This study aims to explore factors that drive perceived price fairness by customers when using an AI-based pricing system. The research model assesses the perceived price fairness of customers based on the varying degrees of AI and personal information employed in the personalized pricing strategy. The study seeks to determine the moderating effects of demographics, particularly age and “tech savviness,” on the relationship between AI and perceived price fairness. Despite the proliferation of dynamic pricing, the current literature lacks a comprehensive understanding of the different level of AI-pricing and consumer fairness perceptions. Furthermore, while data privacy is a known concern, the research gap persists in identifying how factors like age and tech savviness moderates the acceptance of AI pricing. This study fills these gaps by providing a framework that identifies the 'sweet spot' of AI involvement where revenue optimization and consumer trust can coexist.

Title: PM2.5 emissions from Alabama's forest industry and impacts of its regulatory changes

Primary Author: Manisha Subedi

Additional Authors: Manisha Parajuli;Richard Cristan;Lana Narine;

Mentor: Jo Daniel

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: The recently revised primary annual fine particulate matter (PM2.5) standard from 12.0 $\mu\text{g}/\text{m}^3$ to 9.0 $\mu\text{g}/\text{m}^3$ by the U.S. Environmental Protection Agency (EPA) is expected to present challenges for Alabama's forest industry. This study aims to understand awareness and understanding, perceptions, and the potential impacts of new PM2.5 standards. Altogether 73 industries, including sawmills (59), pulp and paper mills (5), pellets mills (3), and oriented strand board (OSB) mills (3), were mail surveyed. Altogether 19 responses with 26 % total response rate, and data analysis was done using R software. The findings revealed that facilities are aware of the new PM2.5 standards, through environmental consultants and industry associations, and are involved in calculating PM2.5 emissions annually using EPA-based methods. However, awareness doesn't significantly vary with mills' type, ownership, scale, and years of operation. Facilities are strongly concerned, moderately prepared, and have moderate technical capacity to respond to the impact of new standards. They perceive that the negative consequences of the new standards outweigh the environmental benefits. Financial impacts, such as higher costs, reduced investment, reduced revenue or profit, and operational impacts such as changes in operational methods and delays, are the most highly ranked impacts than equipment and infrastructure, regulatory, and workforce, and environmental benefits, such as better public health and air quality, being the lowest. Facilities reported on the cost associated with permits and emission control technologies are the current and future economic and financial burden. However, operational modifications are not currently considered but are expected to cause challenges in the future. Facilities have developed cost management and adaptation strategies and are seeking further technical support to respond to new PM2.5 standards. The findings will support informed PM2.5 standards policy decision-making for forestry and environmental stakeholders, which makes Alabama better and balanced in terms of economic growth, healthier communities, and overall environmental quality, particularly in rural areas.

Title: Guiding responsible artificial intelligence use in higher education: A student-centered framework

Primary Author: Margaret Haggerty

Additional Authors:

Mentor: Mark DeGoti

Department/Program: Political Science

College: College of Liberal Arts

Abstract: Artificial intelligence (AI) is becoming more common in higher education, but many students are unsure how to use it appropriately and ethically in academic work. A major challenge is the lack of clear, accessible guidance that helps students understand the difference between using AI as a learning tool and using it in ways that compromise academic integrity. This project created a student-centered resource designed for the Auburn University community to address this gap. The guide introduces basic AI concepts, explains university expectations for transparency and acknowledgment, and provides practical examples of responsible use in academic and professional settings. These examples include using AI to study course material, receive feedback on writing, better understand grading rubrics, prepare for exams, and explore career options. Rather than treating AI as a substitute for student effort, this project presents it as a tool that can support skill development, critical thinking, and ethical decision-making.

Title: Harnessing native bacteria to support resilient lettuce production on agricultural wastewater

Primary Author: Margaret Otto

Additional Authors: Sol Llerena Llerena;

Mentor: Brendan Higgins

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Controlled environment agriculture (CEA) with hydroponics is a \$96 billion industry and the fastest-growing sector of US agriculture, yet expansion is constrained by high operating costs and environmental footprints. Replacing synthetic fertilizers, which are of limited reserves and costly, with agricultural wastewaters (e.g., from poultry processing or aquaculture) could improve both economic and environmental sustainability of CEA. However, these complex nutrient streams may introduce chemical and nutritional stressors that limit crop production. This work seeks to improve the stability and productivity of wastewater-fed recirculating systems by developing a novel plant growth promoting bacteria (PGPB) that colonizes the root zone to enhance performance. Sixty-six *Bacillus* and *Pseudomonas* strains were screened for growth-promoting traits, including phytohormone secretion and nutrient solubilization. Twenty top-performing strains were tested in lab-scale hydroponic systems to support romaine lettuce growth under stressors common to reclaimed wastewater: disinfectant residuals and limited nutrient availability. *Bacillus subtilis* strain JJ-465 emerged as a promising PGPB. Under disinfectant stress (7 mg L⁻¹ peracetic acid), JJ-465 increased marketable yield by 45.1% and root fresh mass by 36.5% ($p < 0.01$), while reducing crop loss from -43.6% to -18.1% relative to unstressed controls ($p < 0.01$). Improvements under phosphorus limitation were smaller but significant (+16.1%, $p < 0.05$), demonstrating that tailored PGPB can survive on wastewater streams and mitigate specific plant stressors. Future work will investigate the mechanisms behind these responses and PGPB performance across other stressors. Waste-derived prebiotic supplementation and microbiome engineering will be explored to enhance inoculant persistence. In all, this work establishes a foundation for transforming agricultural wastewater from a liability into a high-value input for sustainable CEA production.

Title: Evaluation of reproductive hormones and gonadal tissues in feline offspring from AAV-GnRH treated cats

Primary Author: Margaret Schuler

Additional Authors: Arthur Zimmerman;Aime Johnson;

Mentor: Aime Johnson

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Overpopulation of stray cats presents a significant challenge to both animal welfare and public health. Although surgical sterilization remains the primary method of population control, it is resource-intensive, requires trained veterinary personnel, and can impose physical and psychological stress on animals. A non-surgical alternative could reduce these barriers, support large-scale population management, and decrease euthanasia rates in overcrowded shelters. This study evaluates adeno-associated virus-mediated delivery of gonadotropin-releasing hormone (AAV-GnRH) as a potential non-surgical sterilization strategy for domestic cats. AAV is a non enveloped viral vector capable of targeted DNA delivery and long-term gene expression, making it a promising platform for reproductive hormone modulation. Although adult cats treated with AAV-GnRH remained fertile, their offspring exhibited altered luteinizing hormone (LH) concentrations during the first eight weeks of life. These findings prompted further investigation into whether the viral vector or associated immune responses may be transferred vertically from treated parents to their kittens. The current project aims to assess the presence of AAV-GnRH in the gonads of treated animals and their offspring and to characterize additional hormone profiles that may be altered by treatment. Ongoing analyses include qPCR-based detection of AAV antibodies and vector-related sequences in tissues collected from treated adults and their offspring. Preliminary data from three kittens born to a treated mother showed no detectable differences in vector-related sequences from heart or liver tissues compared with untreated controls, though additional sampling is still underway. The gonads of treated cats were also tested alongside those of an untreated negative control. A slight increase in AAV-associated antibodies was observed in treated adults; however, the difference was minimal and not statistically significant. This continuing work will help clarify the potential for vector transfer to offspring, characterize early hormonal changes in neonatal kittens, and provide essential safety and efficacy data for the development of AAV-based, non-surgical sterilization methods.

Title: Study on genome assemblers, statistical determinants, algorithms, and genome assembly pipelines

Primary Author: Maria Victoria Liendro

Additional Authors: John Beckmann;

Mentor: Daniel Tauritz

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Genome assembly is an NP-hard problem, and numerous assembly tools have been developed to address it. However, this abundance raises additional challenges, namely understanding how these tools differ, when to use each one, and what limitations they have. In this study, we evaluate the performance of four commonly used assemblers —SPAdes, Trinity, Velvet, and IDBA-UD—across a variety of simulated datasets designed to stress different aspects of assembly performance.

Title: In Vitro Assessment of Host Cell Susceptibility to H4Nx and H9Nx Avian Influenza Viruses

Primary Author: Mariana Andrioli Pinheiro

Additional Authors: Constantinos Kyriakis;Roberto Molinari;James Krehling;Diego Ernesto Ventura Urbina;Rocio Gerez Miranda;Shakiba Kazemian;

Mentor: Miria Ferreira Criado

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Avian influenza virus (AIV) represents a significant threat to wildlife, food security, and public health. H9 and H4 AIV strains, commonly isolated from wild waterfowl, possess the potential to cross species barriers. In this study, we evaluated the susceptibility and permissiveness of diverse avian-derived cell lines to H9Nx and H4Nx AIV strains isolated from multiple avian species. Viruses isolated from turkey (H9TK, H4TK), wood duck (H9WD), ruddy turnstone (H9RT), blue-winged teal (H4BWT), and mallard (H4ML) were used to infect continuous cell lineages from chicken (DF1), quail (QM5), and duck cells at an MOI of 1. Viral titers were evaluated on 1-, 3-, and 5-days post-infection (dpi) using RT-qPCR and TCID50 assays. All tested cell lines supported replication of H9Nx and H4Nx strains, with viral RNA and infectious particles detectable from 1 dpi. Duck fibroblast cells exhibited higher viral RNA levels and infectious titers than chicken and quail cell lines. Across cell types, H4BWT showed the highest titers among strains and cell lineages, reaching peaks of 4.67 log₁₀ TCID50/mL in DF-1, 5.33 log₁₀ TCID50/mL in duck, and 4.23 log₁₀ TCID50/mL in QM5. Plaque assays revealed strain- and cell-dependent differences in viral fitness and cell-to-cell spread. H4 strains formed larger plaques (1.8–4.2 mm) than H9 strains (1.3–2.5 mm). Plaque size differed significantly across cell types and viral strains, with larger plaques observed in supernatants than in cell monolayers in DF-1 cells (H9RT and H4BWT), duck cells (H9RT, H4BWT, and H4ML), and QM5 cells (H9TK and H4ML). Overall, H9Nx and H4Nx AIVs showed distinct cell-dependent replication patterns, with higher replication observed in duck fibroblast cells. These findings highlight the role of host–virus interactions in shaping in vitro replication efficiency and viral phenotypic diversity. Further studies are underway to identify the factors influencing AIV subtype–avian host interactions.

Title: Training Under Pressure: Investigating Student Mental Health Outcomes Across Cooperative, Competitive, and Individualistic Veterinary Program Climates

Primary Author: Marielle Gomez

Additional Authors: Tracy Witte; Cassidy Chesnutt; Hannah Sawyer; Sydney Waitz-Kudla;

Mentor: Tracy Witte

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Given that veterinary professionals die by suicide at a higher rate and report higher rates of mental health difficulties than the general population, dedicated efforts to improving mental health outcomes within this population are warranted. Veterinary academic programs have worked to implement systemic changes to support student mental health outcomes through mechanisms such as the program's climate. To assess whether veterinary program climate was associated with mental health outcomes, 1,686 veterinary students representing 32 programs across the United States completed a survey where they identified whether they perceived their program climate as "cooperative," "individualistic," or "competitive," and reported on symptom severity of anxiety, depression, burnout, and suicidal ideation. Participants also reported on professional behaviors of peers and faculty, as well as their own educational experiences within the program. Differences in symptom severity endorsement across all three climates was assessed through a multi-group confirmatory factor analysis (MGCFA). Students who perceived their program as cooperative endorsed significantly lower levels of anxiety, depression, burnout, and suicidal ideation. Moreover, students who perceived their program as competitive endorsed significantly higher levels of anxiety, depression, burnout, and suicidal ideation. In characterizing what students constitute as a cooperative program climate, regression results indicated that cooperative climates were more likely to be associated with a supportive peer environment, clear communication and modeling positive behaviors from faculty, as well as sufficient support from program leadership and administration. Together, our results suggest that veterinary programs can improve mental health outcomes of students by promoting a cooperative climate.

Title: Cognitive Function Predicts Distal Gait Mechanics in Older but Not Younger Adults

Primary Author: Marigrace Crossett

Additional Authors: Christopher Wilburn; Kenneth Harrison; Ak Black; Grace Greer;

Mentor: Christopher Wilburn

Department/Program: School of Kinesiology

College: College of Education

Abstract: Cognitive function and gait control share neural substrates, particularly in prefrontal and motor planning regions. Age-related cognitive decline may disproportionately affect ankle mechanics, which require greater executive control than proximal compensation strategies. This study examined whether cognitive function predicts ankle power generation differently across age groups. Twenty participants (10 younger: 23.4 ± 2.1 years; 10 older: 71.3 ± 5.8 years) completed the Montreal Cognitive Assessment (MoCA) and Trail Making Test Part B (TMT-B) before walking overground at self-selected speed. Three-dimensional gait analysis quantified A2 ankle power peaks. Pearson correlations examined relationships between cognitive scores and power peaks within each age group. Older adults demonstrated lower MoCA scores (25.2 ± 2.4 vs 28.8 ± 1.1 ; $p < 0.001$) and slower TMT-B times (98.3 ± 28.7 vs 42.6 ± 12.4 seconds; $p < 0.001$). In older adults A2 ankle power correlated significantly with MOCA scores ($r = 0.72$, $p = 0.019$) and TMT-B performance ($r = -0.68$, $p = 0.031$), with worse performance associated with lower ankle power. In younger adults, no significant correlations emerged between cognitive scores and power peaks (all $p > 0.05$). Cognitive function strongly predicted ankle power generation in older but not younger adults, suggesting age-related increases in attentional demands for distal gait control. The absence of cognitive-gait relationships in younger adults indicates their ankle control remains largely automatic. These findings suggest cognitive interventions may help preserve ankle function and reduce fall risk in aging populations where gait has become attention-demanding.

Title: Mutations in the ERBB4-ERBB2 dimer interface may elucidate the role of these dimers in BRAF-WT melanomas

Primary Author: Markelle Scott

Additional Authors: David Riese; Vipasha Dwivedi; Nick DeFeo; Lauren McGinness; Angelina Shunnarah; Grace Maestri; Emma Simms; Haram Kim; Reed Hilton; Andra Tylke; Deirdre Smith; Tori Huffman; Ella Wilson; Hayden Eldridge;

Mentor: David Riese

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Melanoma is an aggressive and deadly subtype of skin cancer. Approximately half of melanomas harbor a gain-of-function mutation in a BRAF allele. The growth of these tumors is reduced by immune checkpoint inhibitors (ICIs) or a combination of BRAF and MEK inhibitors. Unfortunately, the melanomas that possess a wild-type BRAF allele (BRAF-WT melanomas) are not responsive to targeted therapeutics, and ICIs are not highly effective against these tumors. Thus, our long-term goal is the development of drugs that are effective against BRAF-WT melanomas. We have previously shown that expression of the ERBB4 receptor tyrosine kinase gene is both sufficient and necessary to drive the proliferation of four BRAF-WT melanoma cell lines. ERBB4 encodes a receptor tyrosine kinase that is closely related to the Epidermal Growth Factor Receptor (EGFR), ERBB2 (HER2), or ERBB3 (HER3). Moreover, three ERBB4-dependent, BRAF-WT melanoma cell lines also depend on ERBB2. Previous data indicate that ERBB4 homodimers inhibit tumor cell proliferation. Thus, we hypothesize that ERBB4-ERBB2 heterodimers drive these ERBB4- and ERBB2-dependent, BRAF-WT melanoma cell lines. To test this hypothesis, we are evaluating the activity of mutant alleles that affect the cytoplasmic ERBB2/ERBB4 asymmetric dimer interface. We are testing whether mutations in the N-lobe of the ERBB4 kinase domain cause loss-of-function phenotypes (reduced signaling and stimulation of proliferation) and whether mutations in the C-lobe of the ERBB2 kinase domain cause loss-of-function phenotypes. Finally, we will test whether the activity of loss-of-function ERBB4 N-lobe mutant alleles can be rescued by loss-of-function ERBB2 C-lobe mutant alleles. Positive results would suggest that ERBB4-ERBB2 heterodimers drive the proliferation of ERBB4- and ERBB2-dependent melanomas and that such melanomas will respond to combination therapies that feature FDA-approved anti-ERBB2 agents, including pertuzumab and lapatinib.

Title: Integral Analysis of Non-Newtonian Boundary Layers Over a Circular Cylinder in Crossflow

Primary Author: Mary Ferguson

Additional Authors:

Mentor: Joseph Majdalani

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: This study combines Karman's momentum-integral approach with an optimized fourth-order Majdalani-Xuan (MX4) polynomial approximation of the nearfield velocity across the boundary layer for flow over an infinitely long circular cylinder using a steady, incompressible, non-Newtonian, power-law fluid. Karman's method simplifies the analysis of complex fluid motions, particularly in boundary layers, by providing a manageable procedure to approximate the principal flow characteristics without requiring extensive computations. Historically, the set of Pohlhausen polynomials have exhibited a perplexing characteristic, namely, that of producing increasing errors at higher orders. The present analysis with the MX4 polynomial tests the validity of combining the MX4 velocity approximation with a farfield solution that is applicable to the non-Newtonian motion over a long cylinder in crossflow. This study focuses on power-law fluids, specifically shear-thinning (pseudoplastic) and shear-thickening (dilatant) fluids. This study derives closed-form analytical formulations using the momentum-integral approach for several viscous and thermal boundary layer parameters: skin friction, flow separation angle, boundary layer and displacement thicknesses, pressure distribution, and both local and global Nusselt numbers. Additional properties such as skin friction coefficient, drag coefficient, convection heat transfer coefficient, and cross-streamwise velocity will also be provided following the development of both hydrodynamic and thermal formulations. The study determines the manner by which these parameters change with varying flow behavior index (n), where $n < 1$ for pseudoplastics (whose viscosity decreases with increasing shear rate) and $n > 1$ for dilatant fluids (whose viscosity increases with increasing shear rate). This approach provides deeper insights into the impact of non-Newtonian properties on overall flow physics and energy transfer. The MX4 profile is seen to outperform its Pohlhausen predecessor, and the results validate the MX4 model in more complex flow settings, thereby advancing our understanding of non-Newtonian fluid behavior in boundary layer analysis.

Title: Inferring the body size of the common ancestor of termites and wood-feeding cockroaches

Primary Author: Mary Goldman

Additional Authors: Becca Valentine;

Mentor: Nobuaki Mizumoto

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: A wood-feeding cockroach, *Cryptocercus*, is the sister group to termites, making it a key taxon for understanding the evolutionary transition from sub-social cockroaches to eusocial termites. For termites, it has been hypothesized that smaller size as well as specialization to a wood diet has allowed them to evolve into eusociality. As wood is a diet limited in nitrogen, selection toward smaller body size should mitigate the trade-off between nitrogen deficiency and colony growth. In contrast, *Cryptocercus* cockroaches are sub-social and are considered to reflect the ancestral states of termites, where the selection to mitigate tradeoffs between growth of their family group and access to nitrogen should be weak. Thus, previous studies assumed that the ancestors of both *Cryptocercus* and termites may have been more similar in size to *Cryptocercus*. However, we estimated the body size of the ancestor of termites and *Cryptocercus* to be small, using literature-derived measurements from 131 species of termites and cockroaches. Ancestral states were estimated using five alternative phylogenetic topologies, all of which yielded relatively consistent results. Upon averaging these results, the estimated ancestral body size is approximately $2.25 \text{ mm} \pm 0.063 \text{ mm}$, which is much smaller than *Cryptocercus* and within the range of termites. These results seem to reject assumptions that the body size of the ancestor was close in size to *Cryptocercus*. Our results provide new insight into termite and cockroach social evolution by providing an alternative scenario.

Title: AAV Gene Therapy for GM1

Primary Author: Mary Hadley

Additional Authors:

Mentor: Amanda Gross

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: GM1 gangliosidosis is an inherited lysosomal storage disorder caused by mutations in the GLB1 gene, resulting in a deficiency of the enzyme beta-galactosidase (β -gal) and subsequent accumulation of GM1 gangliosides within lysosomes. This buildup leads to widespread cellular dysfunction, progressive neurodegeneration, and early mortality. There is no current curative treatment. Feline models that closely mimic the human disease phenotype provided a valuable system for researching disease mechanisms and evaluating therapeutic strategies. The objective of this project was to characterize protein concentration and lysosomal enzyme activity in peripheral tissues from normal, untreated, and treated GM1-affected cats to better understand the molecular and functional outcome of the disorder. Protein levels in the liver, heart, spleen, and skeletal muscle were quantified using the Lowry protein assay, while lysosomal enzyme function was assessed through substrate-specific activity assays looking at β -gal and additional lysosomal enzymes: Hex-A, Hex-T, and mannosidase. Normal cats established baseline protein concentrations and enzyme activity levels. Untreated GM1 cats displayed high protein levels and low levels of B-gal activity. Treated cats marked more normal protein levels and B-gal activity. Each cat was necessary for the understanding of protein concentrations and enzyme activity in each category of cat to be able to understand how treatment progresses. RNA isolation was also explored to evaluate gene expression changes. Though technical challenges limited successful analysis.

Title: IRIS film performance in coastal wetland, floodplain, and upland sites

Primary Author: Mary Hinely

Additional Authors: Yaniv Olshansky; Christopher Anderson;

Mentor: Thorsten Knappenberger

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Wetlands are vital ecological systems to the Gulf Coast of the southeastern United States. These systems are characterized by vegetation, hydrology, and hydric soil. In areas with elevated dissolved organic carbon (DOC), hydric soil indicators can be masked by dark soil matrix colors. IRIS (Indicator of Reduction in Soils) films can be used to indicate anaerobic conditions, microbial activity, and a carbon source through paint removal. Iron (Fe) or manganese (Mn) paint is created and applied to each film to indicate reduced soil conditions. Films were deployed in two high-DOC sites in Conecuh National Forest located in southern Alabama. These plots were chosen based on their proximity to blackwater, or waterbodies containing high organic content. IRIS films were deployed in wetland, floodplain, and upland sites to compare reduction in areas of differing elevation and hydrology. Soil samples of each horizon were taken from all six sites, textured, and colored. Four IRIS film deployments containing 5 Mn and 5 Fe films were placed in each site using a soil probe, PVC pipe, and a plastic tube. A total of 240 films were deployed throughout the duration of the project. These were retrieved after 4 weeks of placement, washed, scanned, and cropped in Adobe Photoshop. Cropped scans are then used in R studio to generate color profiles containing statistical data of each film. Films showing 30% or more reduction in the first 15 cm of the film are considered reduced. Films deployed in wetland sites showed significant reduction, with all Fe and Mn films being labeled reduced after statistical analysis. Floodplain and upland site films showed little to no change, with all of the films being labeled not reduced overall. Mn films deployed in wetland conditions showed Fe precipitated back onto the film. Fe films deployed in one wetland site showed Fe precipitate in a line on the film. Both of these conditions signify redoximorphic conditions, or saturated soil seen through chemical processes, within the wetlands. Soil textured at the sites was shown to be primarily silt loam or sandy loam with darker colors. One wetland site contained sandy soils and light colors, also showing significantly higher Fe concentrations on the films. These results allow for further study and will continue to be researched in a lab setting. Further research can contribute to the identification and delineation of important wetland ecosystems that would otherwise not be protected.

Title: What does it mean to matter in sport?

Primary Author: Mary Walker

Additional Authors:

Mentor: Rachel Williams

Department/Program: School of Kinesiology

College: College of Education

Abstract: Psychological mattering refers to the perception that one is valued, important, and significant to others. While sport participation is often linked to positive mental health outcomes, little is known about how athletes internalize relationships with coaches and teammates as feelings of mattering, particularly in relation to team roles and performance expectations. Given the limited research on mattering in sport, an exploratory qualitative approach was used to examine how athletes and coaches experience and define mattering and how these perceptions relate to well-being, performance, and mental health. Participants were recruited via email and completed online screening, consent, and demographic materials. Semi-structured interviews were conducted via zoom. Interviews were transcribed and analyzed using thematic analysis, integrating deductive coding informed by psychological mattering facets with inductive coding to capture sport-specific experiences across team and individual sports. Three primary themes emerged. First, coaches played a central role in shaping athletes' sense of mattering through feedback, attention, and leadership behaviors. Second, athletes reported that their voices and opinions were often valued only when their performance met expectations, leading some to question their place on the team. Third, mattering was closely tied to effort recognition, with athletes emphasizing the importance of having their emotional, physical, and motivational contributions acknowledged. Across themes, mattering was frequently described as conditional and performance-dependent, highlighting the need for coaching practices that foster athlete value beyond performance alone.

Title: Evaluating the effect of different biochar rates with broiler litter and commercial fertilizer on reducing greenhouse gas emissions in cotton production systems

Primary Author: Maryam Saeed

Additional Authors: Debolina Chakraborty;

Mentor: Rishi Prasad

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Application of biochar (BC) has potential to reduce greenhouse gas [GHG; nitrous oxide(N₂O), carbon dioxide (CO₂), methane (CH₄)] emissions due to its high specific surface area and adsorption capacity. However, there is a knowledge gap in identifying optimal BC rate to reduce greenhouse gas in Southeastern (SE) cotton production systems of United States. A two-year field experiment was conducted to evaluate the effect of four BC application rates (0, 4.5, 9, 18 Mg ha⁻¹) with commercial nitrogen fertilizer (135 kg ha⁻¹) and broiler litter (4.5 Mg ha⁻¹) on reducing GHG emissions. Broiler litter (BL) was collected from a commercial poultry house. All treatments were applied one week before the start of the experiment each year. Nitrogen fertilizer (F) was applied in two splits. Southern pine wood BC was applied only once at the start of the experiment. GHG samples were collected biweekly through the cotton growing season using static chambers and analyzed in gas chromatography. Results indicated that different BC rates with varying N sources (BL, F) do not follow a particular trend to reduce GHG emissions. Application of high (18 Mg ha⁻¹) and low (4.5 Mg ha⁻¹) BC rates with BL or F showed minimal or no significant effect to reduce GHG emissions compared to alternative N sources alone application. Within BC and BL treatments, application of 9 Mg ha⁻¹ of BC with BL significantly reduced ($P < 0.05$) CO₂, N₂O and CH₄ emissions by 10%, 46% and 7% compared to BL application alone across years. Similarly, within BC and inorganic F treatments, applications of 9 Mg ha⁻¹ of BC with F significantly reduced ($P < 0.05$) CO₂, N₂O and CH₄ emissions by 3%, 29% and 15% compared to F application alone across year. Our result indicated that within all treatments, the plots in which 9 Mg ha⁻¹ of BC was applied with F contributed less GHG emissions to total global warming potential (GWP) across years. This BC rate has potential to reduce GHG emissions in SE cotton production systems.

Title: Do environmental pressures induce natural DNA uptake in the plant pathogenic bacteria belonging to the genus *Xanthomonas*?

Primary Author: Mason Pearce

Additional Authors: Neha Potnis;

Mentor: Neha Potnis

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Horizontal gene transfer (HGT) is a process by which bacteria exchange genetic material, and this process is proposed to be the driving factor for evolution of the pathogen. Genome comparisons of plant pathogenic bacteria show evidence of HGT, and these events can be traced back to the mode of transfer. HGT occurs three ways in bacteria – natural transformation, transduction, and conjugation. While transduction and conjugation have been experimentally demonstrated in different bacterial genera, natural transformation have been found in only a few bacterial genera, and only two so far in plant pathogenic bacteria, namely, *Ralstonia* and *Xylella*. However, the fact that large regions of the chromosomal genome appear to be under exchange among genomes of closely related bacteria, it is possible that bacteria belonging to other genera also have the ability to undergo natural transformation, yet we do not know exact conditions under which this transfer occurs. Here we are assessing the favorable conditions under which DNA uptake occurs via natural transformation in the genus *Xanthomonas*, a foliar pathogenic bacterium. This is done through an addition of plasmid to the *Xanthomonas* strain that has a visual marker allowing uptake to be quantified in a fluorescent plate reader. So far, we have not observed a detectable uptake under a gradient of salt concentrations ranging from 0 to 0.6 molarity, but when testing under apoplast (leaf interior) and epiphytic (leaf surface) mimicry environments, some uptake has been seen. To be positive this is occurring, this is being retested to make sure it's reproducible and efficiency will be calculated. The findings from this study are expected to enhance our knowledge of unexplored modes of genetic exchange in *Xanthomonas* and the conditions that favor this method.

Title: Slow and Steady: Calculation and Biomechanical Contributors of Lower Back Joint Loading Rate

Primary Author: Matheus Ferreira-Shornack

Additional Authors: Michael Zabala;Ivan Nail Ulloa;Ryan Pollard;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Lower back injuries are common and costly, accounting for approximately 40% of work-related musculoskeletal injuries in the United States and an estimated \$40 billion in annual healthcare expenditures. Even in strength sports such as powerlifting, nearly 25% of athletes report lower back pain. Biomechanical modeling and assessment have been used to characterize loading behaviors and lifting techniques to reduce injury risk. More specifically, the fatigue-failure framework has been shown to accurately and reliably quantify cumulative musculoskeletal injury risk. This approach accounts for the impact of load magnitude and repetition on the fatigue life of musculoskeletal tissue. However, the effect of loading rate remains underexplored, despite its potential impact on injury risk. Cadaveric spine studies found that doubling loading rate can reduce cumulative load tolerance by 67%, highlighting the potential importance of this variable. Despite this, joint loading rate is difficult to measure directly in applied settings. Therefore, this study investigates accessible methods for estimating lower back joint loading rate using external measures such as ground reaction forces. This work will also examine biomechanical contributors (e.g. joint angles and moments) that influence loading rates. These findings can inform technique modifications for injury mitigation. Loading rates will be calculated from a pre-existing dataset of human subject lifting trials. The dataset consists of 36 subjects lifting trays of different masses to different heights while at different angles. Regression analyses will be used to compare different estimation techniques and quantify associations between biomechanical metrics and loading rates. This work aims to develop and validate practical approaches for estimating lower back joint loading rate and to identify modifiable biomechanical metrics that may reduce injury risk during lifting.

Title: Perceptions of Psychological Matterings in Adaptive Sports

Primary Author: Mathew Gibbs

Additional Authors: Rachel Williams Maloney;

Mentor: Rachel Williams Maloney

Department/Program: School of Kinesiology

College: College of Education

Abstract: Defined as feeling significant to those around you, psychological matterings can positively impact well-being and health-related quality of life (HRQOL). Psychological matterings draws upon literature highlighting the importance of social connectedness for mental health. Sport represents a salient context for developing psychological matterings due to close interpersonal relationships, shared goals, and challenges inherent in athletic participation. Adaptive sport constitutes a distinct environment where additional barriers may shape these relationships, athletes' sense of matterings, HRQOL, and well-being. Despite this, adaptive sports remain underrepresented in literature, limiting understanding of the adaptive sport experience. This exploratory qualitative study examined how adaptive sport athletes and coaches understand and experience psychological matterings. Adaptive sport athletes (n = 4) and a coach (n = 1) participated in semi-structured interviews. Thematic analysis identified three themes. Blazing A Path for Others reflected perceptions of matterings through purpose and influence, feeling valued when contributing to awareness, representation, and opportunities. Social Inclusion and Belonging highlighted relational and environmental factors central to matterings, including social support, equitable participation, and growth-oriented culture. Participants emphasized "variety without variance," wherein accommodations enable equal involvement without undermining belonging. This fostered self-efficacy, perseverance, and positive well-being. Threats to Matterings captured barriers diminishing perceived value, including inaccessible equipment, misperceptions about ability, and being underestimated or excluded, negatively impacting motivation, well-being, and HRQOL. Findings extend understanding of psychological matterings in underrepresented sport populations, indicating that feeling valued and included in adaptive sports links to well-being and HRQOL.

Title: Mathematical studies of one-dimensional non-Hermitian topological photonic crystals

Primary Author: Matthew Kuehr

Additional Authors: Junshan Lin;

Mentor: Junshan Lin

Department/Program: Department of Mathematics and Statistics

College: College of Sciences and Mathematics

Abstract: Topological photonic crystals possess unique properties that govern how light propagates through their periodic media, making them highly valuable for engineering optical devices. One of the most crucial properties is the crystal's band structure, which dictates the allowable frequency modes within the given crystal's periodic media. Deeply understanding the relationship between the crystal's physical parameters and its resulting band topology is essential for optimizing these crystals for real world applications. The objective of this research is to analyze the band structures of both Hermitian and non-Hermitian systems, and subsequently classify them to reveal underlying symmetries and potentially useful properties for engineering purposes. To achieve this, we developed software models to solve for band structures based on varying physical conditions, generating a dataset of 2,591 unique samples consisting of numeric eigenvalues and visual representations. We are currently testing unsupervised detection methods utilizing KD-trees to autonomously identify bands from raw data. While this approach successfully labels bands in cases where the bands are disjoint, it can produce inconsistent results when the bands cross or coalesce. Future work aims to robustly resolve these issues to enable automated band feature identification. Solving this problem will pave the way for future work in classification analysis and other methods of data-driven discovery for optical engineering.

Title: Adagrasib, a KRAS-G12C inhibitor, downregulates rifampicin-induced MDR1 activity in LS180 and LS174T human colon cancer cells

Primary Author: Matthew Ledbetter

Additional Authors: Chuanling Xu;Kodye Abbott;Julia Salamat;Satyanarayana Pondugula;

Mentor: Satyanarayana Pondugula

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Chemoresistance limits the effectiveness of chemotherapy in many cancer patients. During multidrug chemotherapy, induction of multidrug resistance protein 1 (MDR1) has been shown to contribute to chemoresistance. MDR1 is an efflux pump that plays a key role in the disposition of more than 50% of clinically used drugs. Therefore, during multidrug chemotherapy, drug induction of MDR1 can reduce the therapeutic efficacy of co-administered chemotherapy drugs, leading to chemoresistance. A clinical anticancer drug that can effectively downregulate drug-induced MDR1 would be beneficial to overcome such drug-induced chemoresistance. We sought to determine whether Adagrasib, a recently FDA-approved KRAS-G12C inhibitor for the treatment of non-small cell lung cancer with the KRAS-G12C mutation, can downregulate the drug-induced MDR1 activity in LS180 and LS174T human colon cancer cells. In the Rhodamine 123 intracellular accumulation assays, Adagrasib, at its therapeutically relevant concentrations, downregulated rifampicin-induced MDR1 activity in both LS174T and LS180 cells. Moreover, when co-treated as a "drug cocktail", Adagrasib decreased rifampicin-induced resistance to SN-38, the active metabolite of irinotecan, in the colon cancer cells. These findings suggest that Adagrasib, at its clinically relevant therapeutic concentrations, could enhance the efficacy of chemotherapy by downregulating the drug-induced MDR1. Thus, Adagrasib, as part of a "drug cocktail" in combinational chemotherapies, may help overcome drug-induced chemoresistance.

Title: Alterations in Minipuberty in Cats With Inherited Lysosomal Storage Disorder

Primary Author: Matthew Rini

Additional Authors: Douglas Martin;Aime Johnson;Arthur Zimmerman;

Mentor: Douglas Martin

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Transient, postnatal elevation in hormone levels (such as reproductive hormones) is gaining recognition as an important factor in future reproductive, cognitive and behavioral development in many mammalian species. In humans, this developmental period, termed minipuberty, occurs between 2 weeks and 6 months of age in males and 2 weeks and 2-3 years in females. This period is characterized by a rise in the gonadotropins, luteinizing hormone (LH) and follicle-stimulating hormone (FSH), and gonadal hormones, testosterone in males and estrogen in females. In males, this testosterone rise results in penile and testicular growth, and in females, the rise in estrogen leads to follicular maturation, although there is more controversy regarding the long-term effects of this period. Growing evidence shows minipuberty is critical for brain development and the maintenance of certain sensory systems, mainly olfaction and hearing, and alterations in minipuberty are associated with several neurodevelopmental diseases including Down Syndrome, Turner Syndrome, Kallmann Syndrome and Prader-Willi Syndrome. Previous work in the lab has confirmed this developmental period also occurs in cats. However, it is a little-studied phenomenon in cats, especially cats with neurodegenerative disease. Therefore, given there is a correlation between reproductive hormones and neurodevelopmental disease, we aimed to characterize postnatal, transient hormone changes in cats with inherited lysosomal disease, namely GM1 and GM2. Here, we find altered postnatal levels of the gonadotropins in affected cats. These cats display sustained elevations in LH rather than distinct peaks as seen in normal cats. Additionally, LH peaks frequently occur in affected cats after LH typically becomes quiescent in normal cats. Future studies will continue to examine alterations in transient postnatal hormones and determine whether these alterations affect cognitive, behavioral and/or reproductive development.

Title: Economic Development and Air Service Impact: A Global and Regional Perspective

Primary Author: Maxton Yeast

Additional Authors: Rebecca Baughman; Daniel Siao;

Mentor: Daniel Siao

Department/Program: School of Aviation

College: College of Liberal Arts

Abstract: Airlines and commercial air service have connected our world for decades, bringing people from across the globe together, driving international trade, travel, and business development. Readily available air service helps drive business investment and economic growth, which are vital to enhancing a community's GDP. Economic development and external investment are crucial to stimulating growth in any area, especially in rural areas with limited connectivity and access to capital. Feeder air service and programs like the Essential Air Service (EAS) help bring in connectivity and prosperity to these underserved rural areas and regions. In this study, Class D Airports in Alabama, Georgia, Tennessee, and Kentucky with commercial air service will be researched to find the economic impact of the air service. Class D airports are categorized as those with an active air traffic control tower, and pilots must establish two-way radio communication within the Class D airspace. Specifically, the GDPs of communities with Class D airports that have commercial air service will be compared with those without commercial air service. Quantitative GDP data collected from the U.S. Bureau of Economic Analysis will serve as the primary research method. To complement the primary process, qualitative data collected from interviews with airport managers within the sample will serve as the secondary research method. The primary objective is to assess the role that regional air service plays in driving economic development in these communities.

Title: Kinetics of antibody expression in rabies gene therapy

Primary Author: Mckenzie Steury

Additional Authors: Douglas Martin;Amanda Gross;Courtney Garrett;Aime Johnson;Arthur Zimmerman;Jyoti Yadav;

Mentor: Douglas Martin

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Rabies kills at least 59,000 people worldwide each year, with over 90% of human rabies deaths caused by rabid dogs. It is almost 100% fatal once symptoms appear, and there is no reliable treatment for symptomatic people or animals. Rabies virus invades the brain, where it replicates. The current prophylaxis protocol recommended by the Centers for Disease Control (CDC) involves administration of the rabies vaccine and rabies immune globulin (RIG). However, the antibodies produced in response to the vaccine or injected directly at the wound site are ineffective in the central nervous system (CNS) because of the blood-brain barrier, which prevents most large molecules from entering the brain. We developed a gene therapy against the rabies virus using an adeno-associated viral (AAV) vector that can cross the blood-brain barrier after an intravenous injection and express broadly neutralizing rabies antibodies into brain cells (AAV-Rab). The key information needed to fully understand the effectiveness of this treatment is how long after AAV administration the antibody expression begins in the CNS and peripheral organs. Our pilot studies indicate that single intravenous administration of AAV-Rab produced high-titer serum neutralizing antibodies by 14 days after treatment. However, the earliest onset of antibody expression is unknown. To measure this, a time kinetics study was performed in which mice (n=6-8) were treated intravenously with AAV-Rab 1×10^{13} vector genomes per kg body weight and tissues were analyzed at 0.5, 1, 2, 3, 5 and 7-days post administration. Anti-rabies antibodies were detected by Fluorescent Antibody Virus Neutralization (FAVN) in serum and immunohistochemistry in the brain. Quantitative polymerase-chain reaction (qPCR) was performed to determine distribution of the AAV in different peripheral organs.

Title: Using aerial imagery and deep learning to identify Alabama poultry farms and evaluate rainfall capture potential.

Primary Author: Md Min-Ha-Zul Abedin

Additional Authors: Carson Edge; Tanzeel Rehman;

Mentor: John Linhoss

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Datasets containing the location of poultry farms are not readily available as a result of industry efforts to safeguard grower privacy. However, anonymized datasets containing geospatial information of poultry farms could be used for planning and response to animal health outbreaks, environmental monitoring, and resource conservation strategies like rainwater harvesting. The objectives of this study were to combine remote sensing imagery and deep learning techniques to create an anonymized dataset of poultry farms in Alabama and to calculate rainfall capture potential (RFCP) for the houses. 2,190 aerial images (30 cm resolution) of Alabama were obtained from the USDA National Agriculture Imagery Program and annotated using a commercial annotation software Roboflow. 8,918 poultry houses were annotated and used to train an object detection model (YOLOv11). The study followed a defined experimental design that structured data preparation, model training, and validation. The model was trained on all annotated houses, and performance was evaluated on held-out regions to test generalization. Images were grouped by South and North Alabama and then assigned to the train, evaluation, and test sets in fixed proportions of 70 percent, 20 percent, and 10 percent. Mean Average Precision (mAP) was 0.982 at an Intersection over Union (IoU) threshold of 0.5. Precision and recall curves indicated reliability across confidence thresholds, with the optimal F1 score reaching 0.96 at a confidence level of 0.525. Results from a Segmentation Anything Model (SAM) were used to estimate broiler house roof areas and estimate RFCP at the county level. In broiler-producing counties, RFCP ranged from 682691 to 816 cubic meters over a year. Roof area estimation error was evaluated by comparing SAM outputs with manual measurements in Google Earth Engine for a validation set of 250 houses. Errors associated with roof area estimation were as high as 21 percent but averaged 14.54 percent. These findings demonstrate the feasibility of combining high-resolution remote sensing and deep learning methods to generate accurate, anonymized geospatial datasets of poultry farms that can support data-driven planning and resource management efforts across the poultry industry.

Title: Lipidomic-Based Identification of Five Salmonella Serovars Using Liquid Chromatography Ion Mobility Mass Spectrometry (LC-IM-MS/MS)

Primary Author: Md Naymor Rahaman

Additional Authors: Ahmed Hamid;Iffat Jerin;Kristen Marshall;Adebowale Oyerinde;

Mentor: Ahmed Hamid

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Pathogenic Salmonella are major foodborne pathogens responsible for significant numbers of hospitalizations and deaths worldwide. Rapid and accurate identification and discrimination of Salmonella serovars are therefore critical for effective clinical management and for minimizing public health risks. Traditional microbiological methods generally find it difficult to accurately discriminate between the serovars due to the high degree of phenotypic and antigenic similarity among them. However, a multidimensional separation workflow provided through ion mobility coupled with liquid chromatography and tandem mass spectrometry (LC-IM-MS/MS) enables the discrimination of the biomarkers. Here, we used LC-IM-MS/MS for accurate identification of five Salmonella serovars. Bacterial samples were cultured in Luria Broth (LB) medium for 16 hours at 37°C with shaking, and lipids were extracted using the Folch method. Numerical multivariate statistical analysis, including principal component analysis (PCA) followed by linear discriminant analysis (LDA), was performed to validate the capability of this method to achieve high-level discrimination. Interestingly, preliminary analysis of the LC-IM-MS/MS data revealed several lipid isomers and conformers, enabling discrimination among Salmonella serovars. This highlights the potential of this approach for clinical diagnostics and public health surveillance.

Title: Holocene stratigraphic variations and isotopic constraints on sediments from the central to the coastal Bengal Basin

Primary Author: Md Riaz Uddin

Additional Authors: Ashraf Uddin;

Mentor: Ashraf Uddin

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: This study examines Holocene sediments based on their depositional and distribution patterns from the central to the coastal Bengal Basin. This study also fingerprints the source terranes of the Miocene and Holocene sediment sequences using Sr isotopic data and Carbon-14 ages and were compared with the provenance history and subsidence mechanism of the coeval sediments in the Bengal Basin. We performed comprehensive whole-rock and trace-element analysis of 12 sediment samples using ME-ICP06, which measured major oxides via ICP-AES, and ME-MS81, which measured trace and rare-earth elements (specifically Sr concentration in ppm) via ICP-MS. Moreover, we analyzed those 12 powdered sediment samples using the MAT 262 Thermal Ionization Mass Spectrometer to determine their $^{87}\text{Sr}/^{86}\text{Sr}$ ratios. We found a very high $^{87}\text{Sr}/^{86}\text{Sr}$ ratio ranging from 0.724 to 0.738 in 12 Holocene sediment samples. Carbon-14 age dating analysis of plant and wood materials from shallow (0 to 20 meters) sediment samples in the coastal Bengal basin also shows an age of 6840 years and a high $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.732. The presence of such high Sr in the core, washed drilling, and exposed sediments indicates that Sr was discharged to groundwater and eventually to the Bay of Bengal via the G-B-M river systems and associated aquifer sediments sourced from the Himalayas. The analyzed Holocene sediments, with such high $^{87}/^{86}$ Sr ratios, indicate that they could have been derived from granite or granodiorite source rocks, possibly S-type light-colored granitic rocks. Groundwater samples from the coastal Bengal Basin to the near-central inlands have $^{87}\text{Sr}/^{86}\text{Sr}$ ratios ranging from 0.715 to 0.731 based on another recent study indicating that groundwater has been receiving higher Sr concentrations from various Himalayan lithotectonic units.

Title: “Safe for Cars” : Does It Mean Safe for Pedestrians? - A Case Study

Primary Author: Md Roknuzzaman

Additional Authors: NsongErnest Asiedu;

Mentor: Huaguo Zhou

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Pedestrian safety at urban crosswalks remains a persistent concern, particularly where design practices prioritize vehicle stopping requirements over pedestrian visibility and decision-making needs. The primary objective of this study was to compare driver yielding behavior when vehicles are positioned at the Stopping Sight Distance (SSD) versus the Pedestrian Crossing Sight Distance (PCSD) at the moment a pedestrian initiates a crossing. PCSD was determined using an established pedestrian sight-distance framework developed by the New Zealand Transport Agency (NZTA). A field-based observational case study was conducted at a marked midblock crosswalk equipped with Rectangular Rapid Flashing Beacons (RRFBs) on a two-lane undivided urban roadway adjacent to a public park in Auburn, Alabama. To maintain consistency across observations, pedestrian crossings were staged under controlled conditions. Video recordings were analyzed to extract vehicle approach speed, vehicle position relative to the crosswalk, vehicle type, lane of travel, and driver yielding outcome. Logistic regression results showed that yielding probability declined with increasing vehicle speed and reduced available distance. At an approach speed of approximately 35 mph, the probability of yielding was estimated to be 25%–60% when vehicles were near SSD, compared with 60%–80% when vehicles were positioned at PCSD. In addition, drivers initiated yielding farther upstream under PCSD conditions (approximately 60–80 ft) than under SSD conditions (approximately 40–50 ft). These findings suggest that reliance on SSD alone may inadequately reflect pedestrian crossing needs and highlight the value of incorporating pedestrian-oriented sight distance measures, such as PCSD, into crosswalk design guidance and traffic control policies.

Title: Molecular and pathogenic characterization of fowl adenovirus serotype 8b associated with inclusion body hepatitis

Primary Author: Md Saidul Haque

Additional Authors: Saiada Farjana;

Mentor: Saiada Farjana

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Fowl adenoviruses (FAdVs) represent a persistent threat to the global poultry industry, primarily as the causative agents of inclusion body hepatitis (IBH). Despite their endemic status in the United States, there has been a notable increase in IBH outbreaks during the 2024-2025; raising concerns regarding the emergence and evolution of circulating field strains. This study provides an update on the molecular and pathological characterization of five FAdV isolates obtained from clinically confirmed IBH cases. The isolates were propagated in specific-pathogen-free (SPF) embryonated chicken eggs, followed by PCR amplification and Sanger sequencing of the hexon gene. Bioinformatic analysis, utilizing SnapGene and MEGA 12 software, employed the Neighbor-Joining method with 1,000 bootstrap replicates to establish evolutionary relationships. All five isolates were classified as FAdV-E, serotype 8b, with ~98-100% sequence similarities. Phylogenetic analysis revealed a distinct monophyletic cluster with two sub-lineages, suggesting the co-circulation of genetically divergent strains. Comparative genomics demonstrated a close genetic relationship with FAdV-E/8b strains from diverse regions, including the Middle East, Asia, and South America. Despite their genetic similarity, pathogenic characterization in chicken embryos revealed observable variability in lesions among isolates, including severe multifocal hepatic necrosis and hemorrhages, as well as growth retardation, renal enlargement with hemorrhage, and chorioallantoic membrane edema. Additionally, *in vitro* infection of primary chicken embryo kidney and liver cells induced consistent cytopathic effects across isolates, characterized by cell rounding and detachment. These findings indicate that hexon gene sequence data alone are insufficient to predict virulence and emphasize the need for whole-genome sequencing and enhanced biosecurity for improved monitoring and control of FAdV-E serotype 8b infections in U.S. poultry.

Title: Tariff and Its Impacts: Evidence from The Fifth Episode of U.S.-Canadian Trade Dispute

Primary Author: Md Sariful Islam

Additional Authors: Daowei Zhang;

Mentor: Daowei Zhang

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: In this study, we examine how renewed U.S. tariffs on Canadian softwood lumber after 2017 affected lumber markets and economic welfare during the most recent phase of the long-running trade dispute between the two countries. Using quarterly data from 1980 to 2024, we estimate how U.S. consumers, U.S. producers, Canadian exporters, and exporters from the rest of the world respond to changes in prices and trade policies. To do this, we use an equilibrium model that links supply, demand, and trade flows, and we apply instrumental-variable regression to measure how sensitive these groups are to price and tariff changes. We find that the tariffs increased U.S. lumber prices by 11%, reduced domestic demand by 6.7%, and increased U.S. production by 8%. These changes generated gains of \$2.8 billion (1982 dollars) for U.S. producers and \$1.23 billion in tariff revenue, but U.S. consumers experienced losses that were 1.30 times larger than producer gains. Canadian producers lost \$1.14 billion, while exporters from the rest of the world saw small gains of \$0.046 billion. Overall, our findings show that reinstated tariffs shifted costs toward consumers and Canadian producers while benefiting U.S. producers and the federal government. These results highlight the broader distributional and welfare consequences of restrictive trade policies in a key building-materials market and provide evidence to inform future U.S.–Canada lumber negotiations.

Title: Early innate immune responses to avian reovirus infection in chicken fibroblast cells

Primary Author: Md. Abu Raihan

Additional Authors: Saiada Farjana;

Mentor: Saiada Farjana

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Avian reovirus (ARV) causes a range of diseases and contributes to immunosuppression in chickens, posing a significant challenge to poultry health. Early innate immune responses to ARV remain insufficiently characterized, particularly in avian fibroblast systems. In this study, we evaluated the expression of twelve innate immune genes in DF1 chicken fibroblast cells following infection with ARV strain S1133. Cells were collected at 24 and 48 hours post-infection (hpi), and transcript levels were quantified by real-time PCR using the $2^{-\Delta\Delta C_t}$ method. At 24 hpi, a distinct early antiviral signature was evident, with OASL showing the strongest and most consistent upregulation, indicating rapid activation of interferon-stimulated gene pathways. CD80 was markedly reduced, suggesting modulation of costimulatory signaling during early infection. By 48 hpi, OASL remained elevated but at a lower magnitude, while CCL4 exhibited the most notable increase, reflecting continued engagement of chemokine-mediated responses. IRF1 and IL-10 also showed modest increases, although these changes were not statistically significant. Other genes displayed minimal or variable regulation at this later stage. Overall, these data suggest a transition from an early, OASL-dominated antiviral response to a more distributed but moderate innate immune profile at 48 hpi. Future work should extend these observations to additional cell types and in vivo models to better define the broader immunological landscape of ARV infection.

Title: CFD analysis of raw pyrolysis bio-oil atomization inside an internally mixed air-blast nozzle

Primary Author: Md. Jahid Hasan

Additional Authors: Hassan Khodaei Jalalabadi;

Mentor: Hassan Khodaei Jalalabadi

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Efficient combustion depends heavily on fuel atomization, which governs droplet size, fuel-air mixing, and spray penetration. Raw pyrolysis bio-oil is a promising renewable fuel, yet its high viscosity, elevated surface tension, and significant water content make atomization difficult. This study performs a detailed 3D transient Computational Fluid Dynamics (CFD) analysis of the atomization behavior of 100% raw bio-oil inside an internally mixed air-blast nozzle with six outlets. A coupled Volume of Fluid to Discrete Phase Model framework is used to capture the transition from liquid sheet formation to droplet dispersion, with emphasis on primary breakup inside the mixing chamber. Stress Blended Eddy Simulation turbulence modeling and dynamic mesh adaptation are applied to resolve interfacial instabilities and shear-driven breakup. Simulations are conducted on a high-performance Linux cluster under operating conditions of 40 psi liquid pressure and 38 psi air-assist pressure. Results validated against experimental trends show that ligament formation initiates rapidly, with the bio-oil reaching the bottom of the chamber in approximately 0.4 ms. Strong vortical structures within the chamber enhance breakup and accelerate droplet formation, while velocity fields illustrate how the air stream drives bio-oil motion and promotes mixing. Sauter Mean Diameter is quantified at each nozzle tip, and droplet trajectories confirm uniform dispersion and improved penetration. The findings provide new insights into the atomization physics of high-viscosity bio-oil and establish a computational framework to support nozzle design and the development of energy-efficient, self-sustaining pyrolysis systems.

Title: Beryllium fluoride promotes eEF2 binding to ribosome and translocation

Primary Author: Megan Fitzgerald

Additional Authors: Alexey Petrov;

Mentor: Alexey Petrov

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: During protein synthesis, ribosomes sequentially read mRNA codons. Ribosome movement over mRNA occurs through the translocation step of translation. Translocation is catalyzed by elongation factor eEF2, which uses energy from GTP hydrolysis to promote translocation. GTP hydrolysis unlocks the ribosomal subunits and allows for thermally driven movement, thus promoting translocation across mRNA. The mechanism of ribosome unlocking by GTP hydrolysis is not well understood. Here, we probed the role of GTP hydrolysis in CrPV IRES translocation by using phosphate analogs to simulate different stages of GTP hydrolysis. The non-hydrolysable analogs GMPPCP and GTPNP were used to mimic pre-hydrolysis and ground state GTP. GDP·AlF₄⁻ and GDP·VO₄³⁻ were used to mimic transition and post-hydrolysis states of GTP hydrolysis. GDP·BeF₃⁻ was used to mimic both ground and post phosphate release states. Binding of eEF2 to the 80S ribosome by phosphate analogs was measured by a ribosome pelleting assay. It showed beryllium fluoride and GMPPCP stabilized eEF2 to the ribosome, suggesting that the ground state is required for efficient binding. Interestingly, GDP·VO₄³⁻ and GDP·AlF₄⁻ failed to promote binding of eEF2 to the 80S ribosome. Single-molecule FRET showed that both GTP and GDP·BeF₃⁻ promoted translocation of CrPV IRES-80S complexes, though translocation with GDP·BeF₃⁻ was around 6 times slower. These results suggest that factor binding is driven by the ground state and factor flexibility promoted by gamma phosphate flexibility or dissociation is necessary for translocation.

Title: Manipulation of the Lewis acid catalyzed esterification mechanism for metal oxide nanoparticle synthesis

Primary Author: Megan Henley

Additional Authors:

Mentor: Byron Farnum

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Metal oxide nanoparticles (NPs) are of high interest due to their size-dependent properties which allow for a wide range of applications in emission, absorbance, energy conversion, and energy storage. Cu₂O (cuprite) has been successfully synthesized via a slow injection method where a copper oleate precursor solution is slowly injected into hot oleyl alcohol, resulting in simultaneous esterification and -OH transfer mechanisms to produce Cu₂O NPs. Upon the addition of a catalytic amount of Ga³⁺ to the copper oleate precursor, the esterification reaction becomes more efficient, and more Cu₂O NPs are produced. By varying the rate of injection and the concentration of the injected Ga³⁺ catalyzed precursor solution, changes in the onset of NP production and yield can be analyzed through tracking carbonyl peaks corresponding to the precursor solution and ester using ATR-FT-IR spectroscopy. Further analysis of the post-reaction solution by UV-Vis absorbance spectroscopy and the isolated NPs by X-ray diffraction reveals the efficiency and identity of NP product formation. Unravelling the complexities of this reaction mechanism for Cu₂O will open the door to explore more complex, novel materials by this Ga³⁺ catalyzed method.

Title: Real time tracking of gene therapy by bioactivated MR probe in GM1gangliosidosis

Primary Author: Mehreen Khalid

Additional Authors: Douglas Martin;Amanda Gross;

Mentor: Douglas Martin

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Gene therapy trials for GM1 gangliosidosis, a rare inherited neurodegenerative disorder caused by the absence of functional lysosomal β -galactosidase, are advancing rapidly. Most current approaches use adeno-associated virus (AAV) vectors to deliver the gene encoding β -galactosidase, enabling cells to produce the functional enzyme. These treatments have shown encouraging results in animal models and human clinical trials. The path to FDA approval, and thus widespread availability to patients, will be streamlined by robust biomarkers to track therapeutic effect. The current methods used to assess treatment response are informative but do not provide information on where in the body the therapeutic enzyme is active (biodistribution), and clinical improvements may take time to become evident. In this study, we evaluated a β -galactosidase (β -gal) activatable MRI probe that generates signal only in the presence of functional β -galactosidase. The probe was tested in vitro and in vivo and compared directly with standard enzyme activity assays. Feline fibroblasts from healthy controls, untreated GM1 cats, and gene therapy treated GM1 cats were imaged using 3T and 7T MRI with the β -gal activatable MRI probe. Cells expressing active enzyme showed higher MRI signal relative to diseased cells, which correlated with measured enzyme activity. In vivo studies in feline model showed MRI signal differences between control and diseased animals following intravenous administration, with no observed safety concerns. This approach used a minimally invasive method to assess therapeutic enzyme activity in real time, enabling direct visualization of biodistribution. Future studies will correlate probe enhancement and biodistribution with clinical outcome.

Title: Dietary stress reveals genotype by environment interactions in recombination rate plasticity

Primary Author: Melika Ghasemi Shiran

Additional Authors: Laurie Stevison; Natalia Rivera Rincon; Harlie Howard; Laney Hill; Spencer Koury; Lauren McCann; Connor Haynes;

Mentor: Laurie Stevison

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Evolutionary genetics seeks to understand how evolutionary processes shape genetic variation. Meiotic recombination generates novel genetic variation. Despite its fundamental role in ensuring proper chromosomal segregation, meiotic recombination is highly variable. Recombination rate varies significantly depending on intrinsic and extrinsic factors, referred to as recombination rate plasticity, which includes environmental stress such as diet, temperature, and age. In addition, as organisms experience stress, their fitness declines. Fitness-associated recombination (FAR) hypothesizes that organisms increase recombination rate as an adaptive response to stress, predicting a negative relationship between RR and fitness. In this study, we use *Drosophila melanogaster* from the *Drosophila* Genetic Reference Panel (DGRP) to test whether caloric density and genotype influence recombination rate. Previous work in our lab has shown that diet alters recombination, with a difference between low calorie (0.5x) and high calorie (2x), and some differences in genetic background based on two DGRP stocks. Here, we extended our study to include up to five DGRP stocks and additional intermediate dietary treatments. We measured recombination, fecundity, survivorship, nondisjunction, and body mass. Recombination and nondisjunction were quantified using seven X-linked visible markers, while egg-to-adult emergence assays were used to assess fecundity, fertility, and survivorship. Our results showed that dietary manipulation at the extremes (0.5x and 2x) did not significantly reduce survival. Also, our diets did not significantly alter nondisjunction rates. However, diet and genetic background had significant effects on recombination rate, suggesting genotype-by-environment (GxE) interactions, with two clear trends identified. Furthermore, increased recombination was not associated with reduced survival, regardless of strain, providing little support for the (FAR) hypothesis. Our results highlight important factors such as condition and genetic background to consider in any study on genetic variation. Because recombination plasticity was not associated with reduced fitness, these changes do not appear to be adaptive, indicating that further work is needed to understand how evolutionary processes explain recombination rate plasticity.

Title: Access Matters: Healthcare Barriers and Caregiver Burden Among Parents of Children With Chronic Conditions

Primary Author: Michael Kelly

Additional Authors: Kathy McAdory;

Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Caring for a child with a chronic condition is a complex, lifelong responsibility that places significant physical, emotional, financial, and social demands on parents and family caregivers. Caregivers must manage appointments, treatments, symptom monitoring, and daily care while balancing work and family responsibilities, often leading to exhaustion, stress, and burnout. Caregiver burden is a multidimensional construct that is strongly influenced by access to healthcare, including insurance, affordability, transportation, provider availability, and care coordination. When access is limited, caregivers experience delayed care, increased crises, and heightened stress. Despite the growing number of children with chronic conditions, pediatric caregivers remain understudied, particularly regarding how healthcare access shapes caregiver burden. Understanding this relationship is essential to inform family-centered interventions, policy, and health system improvements that reduce caregiver strain and improve child health outcomes. Therefore, the purpose of this study is to examine the relationship between healthcare access and caregiver burden among parents of children with chronic conditions. This study will use a cross-sectional, descriptive correlational survey design to examine the relationship between healthcare access and caregiver burden among parents and primary caregivers of children with chronic conditions. Participants will include caregivers of children ages 0–18 years who require ongoing medical management and are recruited from community-based settings, including clinics, schools, and outreach programs. Surveys will be distributed electronically using a secure online platform, with paper versions available as needed to reduce participation barriers. The survey will collect caregiver and child demographic information, assess healthcare access factors such as insurance, affordability, transportation, provider availability, and care coordination, and measure caregiver burden using a validated caregiver burden instrument. Descriptive statistics will summarize sample characteristics, and correlational and regression analyses will be conducted to examine associations between healthcare access and caregiver burden, with statistical significance set at $p < .05$. Data will be captured and analyzed in February 2026. Findings from this study are expected to demonstrate a significant relationship between healthcare access and caregiver burden among parents of children with chronic conditions. Limited access to insurance coverage, affordable services, transportation, and coordinated care may contribute to increased emotional, physical, and financial strain for caregivers. These findings have important implications for nursing practice, community health programs, and policy efforts aimed at reducing caregiver burden through improved access to pediatric healthcare services.

Title: Simulating hydrodynamic interactions in colloidal suspensions using multiparticle collision dynamics with rigid-body constraints

Primary Author: Michaela Bush

Additional Authors: Michael Howard;

Mentor: Michael Howard

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Multiparticle collision dynamics (MPCD) is a mesoscale particle-based simulation method for simulating hydrodynamic interactions in soft materials. These interactions play a critical role in numerous technological applications from cellular transport to self-assembly of nanocrystals. MPCD uses a particle-based solvent that exchanges momentum through spatially localized stochastic collisions. Colloidal particles can be represented in MPCD by discretizing their surfaces into particles that also participate in these collisions, and this approach has recently been shown to reliably describe the diffusion and sedimentation of colloidal particles with a variety of shapes. However, in this prior work, a network of stiff springs was needed to maintain the discretized model for the colloidal particles, creating a tedious process for configuring the simulations and restricting the integration timestep. In this work, we overcome these limitations by incorporating rigid-body constraints into MPCD. We implement these constraints in the HOOMD-blue simulation package with support for CPU and GPU, then characterize the accuracy and performance of our rigid-body approach compared to stiff springs. Our work facilitates convenient MPCD simulations of suspensions of colloidal particles with complex shapes, and has enabled in-depth analysis to better optimize the parameters used to design the colloidal particles.

Title: Fractured Foundations: Does divorce impact college students' academic performance, mental health, financials, and relationships?

Primary Author: Michaela Stanik

Additional Authors: Brian McCabe;

Mentor: Brian McCabe

Department/Program: Special Ed, Counseling Psychology and School of Psychology

College: College of Education

Abstract: The connection between parental divorce and negative effects on mental health, finances, relationship functioning, and academic performance has been firmly established. One group that may experience an increase in the negative impacts of their parents' divorce is emerging adults (ages 18-25 years), especially those attending college. Emerging adults are continuing to develop their independence, sense of self, and are likely to be pursuing postsecondary education, thus increasing their exposure to the stressors associated with their parents' divorce. This mixed-method research study will investigate the relationship of parental divorce with depressive symptoms, financial instability, relational functioning, and academic performance among emerging adults who are currently in college. Approximately 200 college students between the ages of 18-25 will complete a confidential online survey to quantify their parents' marital status, as well as their own depressive symptoms, financial wellness/distress, family dysfunction, attachment to and communication with parents/peers, feelings of loneliness, academic self-efficacy, engagement vs. disaffection with learning, and self-reported grade point average (GPA). Quantitative analyses will compare the two groups (those with divorced parents and those with continuously married parents) on variables related to parental divorce, financial strain/instability, mental health, relational functioning, and academic performance. Additionally, 20 participants will be interviewed using semi-structured questions regarding their experiences with parental divorce, finances, and relationships as they pertain to academics while attending college. The interview transcripts will be thematically analyzed to provide a qualitative context for the quantitative analyses. The results will provide a clearer understanding of how parental divorce affects functioning during emerging adulthood.

Title: Prenatal cannabis exposure disrupts hippocampal synaptic plasticity in adolescent rats: Rescue by Gabazine

Primary Author: Miles Wiley

Additional Authors: Vishnu Suppiramaniam; Savannah Perman; Vasiliki Syropoulou; Adrian Courville; Kawsar Chowdhury; Warren Smith;

Mentor: Miranda Reed

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Cannabis is the most used illicit substance during pregnancy, and its use is expected to increase as legalisation expands, with 39 states permitting medical use and 19 permitting recreational use. Compounding this concern, the concentration of $\Delta 9$ tetrahydrocannabinol (THC) in cannabis has more than doubled worldwide over the past four decades. Clinical studies indicate that prenatal cannabis exposure (PCE) is associated with long-lasting learning and memory deficits in offspring, yet the synaptic mechanisms underlying these impairments remain poorly understood. Synaptic plasticity is widely regarded as the cellular correlate of learning and memory. In this study, we tested the hypothesis that PCE disrupts hippocampal synaptic plasticity through enhanced GABAergic inhibitory signalling. Pregnant dams were exposed to $\Delta 9$ THC at 5 mg per kg per day via subcutaneous injection from gestational day 5 through postnatal day 9. Synaptic plasticity was assessed in adolescent offspring using extracellular hippocampal field recordings. PCE resulted in significant deficits in long-term potentiation in both male and female offspring. In parallel, we observed enhanced long-term depression in both sexes, indicating a shift in synaptic plasticity toward synaptic weakening rather than strengthening. These impairments were rescued by gabazine, a GABAA receptor antagonist, implicating excessive inhibitory neurotransmission as a key mechanism underlying the observed synaptic plasticity deficits. Importantly, inclusion of both sexes addresses a critical gap in the PCE literature, which has historically focused predominantly on males, despite growing recognition of sex as a biological variable in neurodevelopmental research. Together, these findings demonstrate that PCE produces persistent alterations in hippocampal synaptic plasticity by biasing neural circuits toward inhibition-driven synaptic weakening, providing a mechanistic link between PCE and cognitive dysfunction.

Title: A review of advances in pan-(K)RAS inhibitors: Targeting multiple RAS isoforms beyond mutant-specific KRAS inhibitors

Primary Author: Millison Mixon

Additional Authors: Gary Piazza;Khalda Fadlalla;Kristy Berry;Chung-Hui Huang;Yulia Maxuitenko;Junwei Wang;Sindhu Ramesh;Adam Keeton;

Mentor: Adam Keeton

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Activating mutations in the three canonical RAS genes, KRAS, NRAS, and HRAS, account for approximately 30% of human cancers. These mutated genes contribute to many defining features of cancer, including immune evasion, aberrant cell growth, and metastatic progression. Their significant influence on tumor initiation and progression has made RAS genes the focus of extensive scientific research over the past few decades, yet they have been historically considered “undruggable” due to the lack of suitable binding pockets and the picomolar affinity of RAS for GTP/GDP, which limited the development of effective small molecule inhibitors. Although mutant KRAS isoform-specific inhibitors have shown strong therapeutic potential and two agents are currently FDA approved, their clinical impact is inherently limited by their narrow mutation selectivity, as they target only the KRAS G12C isoform. In addition, tumor heterogeneity and adaptive signaling through non-targeted RAS isoforms are parallel pathways that result in maintenance of oncogenic signaling despite selective inhibition. This can further limit therapeutic durability. Developing a broadly potent yet safe inhibitor of activated RAS across isoforms remains one of the most pressing challenges in oncology today. This literature review focuses on recent advances in pan-(K)RAS inhibitor development, evaluates their efficacy, and discusses their potential clinical implications for expanding therapeutic breadth and improving patient outcomes. The results of this literature review found emerging pan-(K)RAS inhibitors, both in clinical and preclinical development, have the potential to achieve greater potency, broader target coverage, distinct mechanisms of action, and better therapeutic outcomes.

Title: Gender norms and mental health: Counseling across identities

Primary Author: Miriam Stark

Additional Authors: Becca Hill;

Mentor: Danielle Boyd

Department/Program: Counseling Leadership and Special Education

College: College of Education

Abstract: The number of gender diverse people continues to grow, and there is a need to ensure counselor competency around having therapeutic conversations with clients without imposing non-salient gender norms. Through systematic literature review, nine peer-reviewed articles were chosen by searching the following keywords: gender norms, mental health, masculinity, femininity, gender-neutral language, and counselor competency. The research indicates best gender-affirming care practices for mental health counseling and other helping professionals to include: validating diverse gender expressions and sexual orientations of clients, recognition of the lived experiences of gender diverse individuals, acknowledge gender norms negatively affect both cisgender and gender non-conforming individuals, the benefits of using gender neutral language, and the importance of counselor self-awareness around biases. The review urges mental health professionals to pursue continued education to ensure counselor competency on gender-affirming care.

Title: Exploring non-communicable disease trends through community health outreach in the Maldives

Primary Author: Mit Patel

Additional Authors:

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: The Maldives, widely recognized for its scenic island geography, is experiencing a growing burden of noncommunicable diseases (NCDs), diabetes mellitus, hypertension, and sleep-related disorders. Despite this emerging public health concern, limited community-level data are available to characterize these conditions across island populations. This research examines how community health outreach and screening initiatives can be used to identify patterns related to cardiometabolic and sleep health and to inform future public health efforts. As part of an international outreach collaboration, health screening activities were conducted across multiple Maldivian islands to assess blood pressure, blood glucose levels, and sleep-related indicators using standardized measurement tools and questionnaires. Demographic and health history information was collected to contextualize observed health patterns. Screening observations revealed a notable presence of elevated blood pressure and blood glucose levels, aligning with global trends in the rising prevalence of NCDs. Associations between increasing age and hypertension were observed, suggesting the importance of age-focused screening strategies. Additionally, elevated blood glucose levels were more frequently noted in individuals with a family history of diabetes mellitus, highlighting the role of hereditary risk factors. Lifestyle factors commonly reported in the region, including regular consumption of caffeine and betel nut, and sleep disturbances, emerged as potential contributors to health risk and warrant further investigation. Overall, this project underscores the value of community-based outreach and international collaboration in generating baseline health insights, raising awareness, and supporting preventive public health strategies. These findings emphasize the need for continued education, routine screening, and evidence-informed interventions to address the growing NCD burden in island and resource-limited settings.

Title: Automated Detection and Quantification of Electrically Induced Bearing Damage in SEM Images

Primary Author: Moises Munoz Paredes

Additional Authors: Robert Jackson; Sudip Saha;

Mentor: Robert Jackson

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Electrically induced bearing damage (EIBD) is a growing concern in electric vehicles, where stray currents pass through the rolling element contact surfaces leading to surface degradation, pitting, and premature failure. To better understand and mitigate these effects, researchers perform tribological experiments under similar operating environments. A critical step involves imaging experiment samples using scanning electron microscope (SEM) to detect and quantify the damage. Currently, there is no standardized or automated approach for accurately detecting and quantifying the pitted surfaces of EIBD. Dependence on manual annotation introduces variability due to human error, bias, and fatigue. Thus, the purpose of this study was to develop and evaluate an automated method for detecting and quantifying EIBD using deep learning-based image segmentation (i.e. artificial intelligence). SEM images of samples containing electrical induced damage were collected from the research group's experimental database. The images were annotated using Roboflow's instance segmentation tool to identify damage regions. Image augmentations were applied to expand the dataset and improve model robustness. The You Only Look Once (YOLO) model was then trained using the Python programming language in the PyCharm environment. This project utilized the YOLOV11s-seg model. The framework resulted in a mean Average Precision of .712 for mask-based segmentation with a recall of .779 and precision of .599 indicating reliable detection performance. Compared to manual annotation, the YOLO based approach reduced image analysis time by 99.5%. When compared to manually calculated damage area percentages, the model's per-image predictions exhibited an average percent error of 16.67%. Future efforts will focus on enhancing performance by increasing the training dataset size with more images and image augmentation techniques.

Title: Differential regulation of gonadal steroidogenesis by estrogenic chemicals

Primary Author: Morgan Smith

Additional Authors:

Mentor: Benson Akingbemi

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Consumer products contain endocrine-disrupting chemicals (EDCs), which are thought to cause adverse effects in the male reproductive tract. For example, soy-based diets are commonly used by the population, but soybeans contain isoflavones, which possess estrogenic activity and capacity to disrupt hormone function. The industrial chemicals bisphenol A (BPA) and bisphenol S (BPS) are used in the manufacture of food and drink containers and water bottles. However, BPS is considered safer than BPA and a potential replacement in consumer products. On the other hand, the 17 α -ethinyl estradiol (EE2) compound is present in oral contraceptive pills. EE2 is known to contaminate water supplies and is an increasing public health concern. Altogether, the population is exposed to multiple chemicals. Of interest, EDCs are known to disrupt steroid hormone production in steroidogenic tissues such as the testes.

Title: Influence of Patient Anthropometrics on Loading Rates in Ankle-Foot Orthoses

Primary Author: Morgan Wootton

Additional Authors: Michael Zabala;Jaxie Brokamp;

Mentor: Michael Zabala

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Ankle-foot orthoses (AFOs) are commonly prescribed devices used to support ankle joint motion and improve gait efficiency in individuals with a range of neuromuscular and musculoskeletal impairments, including foot drop and equinus deformity. Given their widespread clinical use, understanding the mechanical behavior of AFOs, specifically their fatigue life, is essential for evaluating long-term performance and durability. Despite this need, there is currently no standardized protocol for fatigue testing of AFOs, and physiologically relevant loading conditions remain poorly defined. Loading rate, defined as the rate at which force is applied to the AFO following heel contact, provides a quantitative measure of how rapidly mechanical loads are introduced during gait. Characterizing loading rates during walking may therefore inform fatigue testing protocols by establishing realistic loading conditions. Furthermore, patient-specific anthropometric factors such as height and body mass may influence the loading rate experienced by an AFO. In this study, loading rates were quantified using ground reaction force data collected from healthy participants walking while wearing an AFO. Loading rate was calculated as the slope of the vertical ground reaction force curve from initial contact to the first peak. Associations between loading rate and participant anthropometrics, including height and body mass, were evaluated using correlation analyses. It is expected that loading rate will exhibit a positive relationship with body mass, with greater body mass resulting in higher loading rates and increased mechanical demand on the AFO. These findings aim to support the development of gait-informed, patient-specific fatigue testing methodologies for AFOs.

Title: Domain-Adapted SDXL-LoRA Diffusion Augmentation Enables Active Learning for Robust Root Hair Microscopy Instance Segmentation and Phenotyping

Primary Author: Muhammad Waseem

Additional Authors: Tanzeel Rehman;Alvaro Sanz Saez de Jauregui;Sharmin Sultana;

Mentor: Tanzeel Rehman

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: This study proposes a low-intervention active-learning framework to improve instance segmentation of microscopic root hairs for high-throughput phenotyping. An initial labeled dataset was used to train a YOLOv12 detector to localize root hair regions via bounding boxes, which were subsequently used as prompts to fine-tune a SAM3 segmentation model for instance-level mask generation. Starting from a baseline segmentation accuracy of 82.32% (Dice), the framework introduces an iterative active-learning loop that reduces reliance on additional manual annotation by leveraging domain-adapted synthetic data. Specifically, Stable Diffusion XL (SDXL) was adapted with a custom LoRA and prompt-controlled generation (Banana Pro) to synthesize microscopy-like root hair images that span challenging conditions, including variable hair density, overlap, weak contrast, blur, and background artifacts. Candidate samples were iteratively incorporated to refine the detector-segmenter pipeline, targeting failure modes not adequately represented in the original labeled set. After active learning, evaluation on 111 test images (2310 instances; 20.8 instances/image) achieved a mean Dice score of 0.925 ± 0.087 and mean IoU of 0.869 ± 0.102 , demonstrating a substantial performance gain and improved robustness across diverse imaging conditions. The proposed methodology offers a scalable approach for continuously improving root-hair segmentation accuracy while minimizing annotation burden, thereby enabling reliable morphology quantification in large-scale microscopy workflows.

Title: Evaluating climate resilient rabbiteye blueberry genotypes with enhanced fruit quality for small growers in Alabama

Primary Author: Mula Pavani

Additional Authors: Sushan Ru;Elina Coneva;Marlee Trandel;

Mentor: Sushan Ru

Department/Program: Horticulture

College: College of Agriculture

Abstract: The rapid increase in global blueberry demand has driven significant industry expansion over the past two decades. The United States is the world's leading producer, accounting for approximately 32% of global production, with nearly 28% of the fresh-market supply originating from the southeastern United States. Rabbiteye (RE) and southern highbush (SHB) blueberries are the primary types cultivated in this region. Rabbiteye blueberries (*Vaccinium virgatum* Ait., $2n = 6x = 72$) are well adapted to southeastern climates due to their tolerance to biotic and abiotic stresses and are considered a climate-resilient option for small growers; however, their commercial adoption is limited by lower fruit quality. In contrast, SHB cultivars exhibit superior fruit quality but require intensive frost protection and management and have limited adaptability, making them less viable for small growers. Therefore, this project aimed to evaluate and identify promising RE cultivars with improved fruit quality for Alabama conditions. Twenty-two rabbiteye genotypes obtained from the University of Georgia (UGA) and Mississippi State University (MSU) breeding programs, along with a few SHB cultivars used as quality checks, were evaluated at the E.V. Smith Research Center (Tallassee, AL) and the Brewton Agricultural Research Unit (Brewton, AL) during the 2024 and 2025 seasons. Genotypes were established using a randomized complete block design with three replications and three plants per replication. All genotypes were evaluated over two years for bloom and harvest phenology, yield per plant (g), plant height (cm), mortality rate (%), and key fruit quality traits, including average berry weight (g), firmness (g mm^{-1}), titratable acidity (TA, %), total soluble solids (TSS, °Brix), and the TSS:TA ratio. Results over two years showed superior performance of several RE genotypes, including T-3072, T-3075, and 'Brightwell', for berry size, berry weight, balanced acidity, and yield in AL.

Title: Simulating the risk of eutrophication downstream of reservoirs: A regional scale perspective

Primary Author: Mumtahina Rahnuma

Additional Authors: Nitin Singh;

Mentor: Nitin Singh

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: In the past few decades, we have built thousands of reservoirs across the Southeast United States to meet our demands for energy, food, and water. While these reservoirs provide a range of ecosystem services, they also serve as “instream reactors” and alter water quality along the river network. Hence, to better manage these reservoirs and sustain the services they provide, there remains a need to advance our understanding of hydrological and biogeochemical processes that govern these managed aquatic ecosystems. However, to date, it remains unclear about the amount of nutrient retention in the reservoir, to what extent reservoirs contribute to eutrophication downstream of reservoirs, and what the key drivers are that could explain these patterns. To address this knowledge gap, we studied the upstream and downstream TP (Total Phosphorus) concentration of several reservoirs in the SE USA and used a Bayesian framework to model the downstream TP concentration and incorporated covariates to understand the drivers for eutrophication risk. Downstream TP concentration varies widely across reservoirs, with many dams reducing exceedance probability (0.1 mg/l) relative to upstream conditions, while some run-of-river dams show limited phosphorus retention. The spatial pattern of downstream TP exceedance probability shows heterogeneity, with high concentration sites located in Florida and North Carolina, while low probability in the reservoirs of Alabama. Covariate analysis shows no universal control on downstream TP concentration, with land use being the most frequent significant driver at individual sites, while climatic parameters emerge as the only consistent regional-scale driver. This study will highlight the underlying mechanisms that drive nutrient processing in reservoirs and their implications for water quality downstream. The findings will contribute to better management of reservoirs and water quality across the Southeast United States.

Title: Do distinct rhizobial associations reinforce kudzu promotion and native legume suppression?

Primary Author: Myles J. Wright

Additional Authors: Claudia Stein; Robert Kiefer; Benedict Okeke;

Mentor:

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Invasive plants can alter soil microbial communities in ways that reinforce their own success and suppress native species. Kudzu (*Pueraria montana* var. *lobata*), a highly invasive legume in the southeastern United States, forms symbiotic relationships with nitrogen-fixing bacteria (rhizobia) that enhance its growth. Previous greenhouse experiments in our system showed that kudzu-associated soil biota suppress the growth of native legumes while promoting kudzu, suggesting host-specific plant-microbe interactions. However, it remains unclear whether kudzu and native legumes associate with the same or different rhizobial strains. We isolated bacteria from root nodules of kudzu and the native partridge pea (*Chamaecrista fasciculata*) grown in sterile soil, kudzu-invaded soil, or uninvaded soil. Nodule isolates were cultured on selective media, and the 16S rRNA gene was amplified using universal primers (27F/1492R) and sequenced for taxonomic identification. We then compared bacterial identities between host species to evaluate overlap and host specificity. Preliminary results suggest differences in the composition of nodule-associated bacterial communities between kudzu and partridge pea. These findings indicate that host-specific rhizobial associations may contribute to positive feedbacks that favor kudzu invasion and suppress native legumes. Identifying whether invasive and native legumes share compatible rhizobia provides mechanistic insight into how microbial symbioses influence invasion dynamics and informs restoration strategies in invaded prairie ecosystems.

Title: Effect of biochar on growth and crown architecture of Japanese maple

Primary Author: Naga Spurthi Acharam

Additional Authors: Hao Chen;

Mentor: Georgios Arseniou

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Urban trees grow under open-canopy conditions that promote broad crowns and complex branching, but their development is often constrained by management practices such as pruning, compacted soils, and restricted rooting space. These conditions make urban tree systems useful for understanding how soil amendments influence growth and crown architecture. Biochar is a porous, carbon-rich material known to improve soil structure, porosity, nutrient availability, and water retention, yet responses of woody plants to biochar are highly variable across species, application rates, and time scales. We are conducting a year-long pot experiment using two Japanese maple cultivars grown with biochar-amended soil and unamended controls to assess effects on growth and structural development. Growth is evaluated using height, stem diameter, dry biomass, and leaf area, while crown architecture is quantified using terrestrial laser scanning with path fraction and box-dimension metrics. Preliminary results show that growth increased over time in both treatments, but differences between biochar and control did not systematically increase during the first six months. This pattern aligns with findings from pot-based biochar studies on woody seedlings, which frequently report weak or neutral early growth responses, with stronger effects emerging later in development or under stress conditions. Continued monitoring through the full growing season will determine whether biochar influences canopy structure and growth trajectories over time, informing its potential use as a long-term soil amendment in urban tree management.

Title: Comparative Evaluation of Metal-Oxide Nanoparticles for Stabilization of Expansive Soils

Primary Author: Najibullah Zulfeqar

Additional Authors: Nick Zou;

Mentor: Ali Khosravi

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Expansive soils present major geotechnical challenges due to their high plasticity and susceptibility to volumetric changes during wetting and drying cycles. This study evaluates the influence of selected metal oxide nanoparticles MgO, Al₂O₃, Fe₂O₃, TiO₂, and ZnO on the index and mechanical properties of an expansive soil. Experimental results indicate that nanoparticle addition alters soil behavior through physicochemical interactions at the particle scale. Among the materials investigated, MgO produced the most pronounced reduction in plasticity, decreasing the plasticity index by approximately 29% at a 3% dosage. This improvement is likely associated with microstructural and physicochemical interactions between nanoparticles and soil particles, although the governing mechanisms require further investigation. Swell testing demonstrates substantial reductions in vertical swell strain, particularly for MgO and Al₂O₃ treatments, which achieved decreases of about 68% and 50%, respectively. These reductions are associated with improved interparticle bonding and partial pore filling by nanoparticles, which restrain water ingress and mitigate swelling pressures. Strength testing further confirms that nanoparticle incorporation enhances load bearing capacity, with MgO treated specimens exhibiting the highest peak strength. The observed increase in strength is consistent with improved soil fabric, increased particle interlocking, and more distributed cracking patterns that indicate enhanced ductility. The findings show that metal oxide nanoparticles can significantly modify the microstructure and interparticle forces of expansive soils, leading to measurable improvements in plasticity, swelling resistance, and strength. The results highlight the potential of nanoparticle based stabilization as an effective strategy for controlling expansive soil behavior in geotechnical applications.

Title: Gentle Guidance Amid Hardship: Predictors of Child Prosocial Behavior in Single Mother Households

Primary Author: Nana Adjoa Konadu Attiah

Additional Authors: Adrienne Marks; Gabrielle Pfund;

Mentor: Adrienne Marks

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Single mother-led households represent a significant yet understudied family structure, and experience material hardship at a higher rate than other family structures. Material hardship encompasses unmet basic needs and parenting practices such as nonviolent discipline may shape children's prosocial behavior, including empathy, cooperation, and sharing. This study applies developmental cascades theory to examine how early material hardship and nonviolent discipline interact to influence prosocial behavior from early to middle childhood. Employing a longitudinal design using data from the Future of Families and Child Wellbeing Study (FFCWS), this study analyzed 2,282 single mother-child dyads across ages 3, 5, and 9. Multilevel growth modeling assessed whether material hardship and nonviolent discipline at age 3 predicted prosocial behavior over time. Nonviolent discipline was also tested as a moderator. Measures included the Parent-Child Conflict Tactics Scales (CTSPC), Adaptive Social Behavior Inventory (ASBI), and a 10-item material hardship index. Analyses were conducted using R (lme4 package), with multiple imputations for missing data. Results from this study indicate that children's prosocial behavior declined on average over time. Higher initial nonviolent discipline predicted greater average prosocial behavior but did not influence change trajectories. Material hardship was negatively associated with average prosocial behavior, though it did not predict year-to-year changes. No significant interaction was found between nonviolent discipline and material hardship, suggesting independent effects. Nonviolent discipline and material hardship independently influence children's prosocial development in single mother households. While nonviolent discipline promotes prosocial behavior, it does not buffer against the adverse effects of economic hardship. These findings highlight the need for structural support alongside parenting interventions to foster child socioemotional wellbeing.

Title: Nutrient removal from poultry processing wastewater using tidal-flow constructed wetland

Primary Author: Natacha Kabata Kakama

Additional Authors: David Blersch;Gabriel Presotto;

Mentor: David Blersch

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: Tidal flow constructed wetlands have emerged as a promising, sustainable solution for treating high-strength wastewater, using natural processes involving soil, vegetation, microbes, and natural energy. The tidal flow system alternates between flooding and draining cycles, introducing oxygen into the wetland matrix and promoting nitrification and denitrification. A laboratory-scale tidal flow constructed wetland system has been designed to evaluate its performance in removing pollutants, specifically nutrients such as nitrite, nitrate, ammonium, and phosphate, from poultry processing plant wastewater. Experiments with this wetland system used 16 replicate TF-CW mesocosms. The soil layers varied across trial conditions: limestone with shredded paper for a denitrification zone; coarse gravel mixed with pea gravel; proprietary substrate with biochar; proprietary substrate with a Typha plantation; and proprietary substrate with biochar, a denitrification zone, newspaper, and a Typha plantation. The tidal flow operated with alternating filling and draining periods of 12 hours, treating 7.5 gallons of high-strength poultry processing wastewater over 7 to 14 days. Treatment performance was assessed by regularly monitoring nitrite, nitrate, ammonium, and phosphate. Preliminary results indicate the overall treatment potential of tidal flow constructed wetland operation on poultry processing wastewater and suggest variation across layers and treatments. The removal of ammonium nitrogen using plants, biochar, and shredded paper for a denitrification zone, and the mixture of all these variants was successful, and phosphate was also removed at a reasonable yield. Further studies will focus on replication to determine first-order removal rate constants for the wastewater constituents and to refine a model for the treatment of poultry industry wastewater.

Title: Mobile Clinic with Hispanic Populations in Rural and Underserved Areas

Primary Author: Natalie Barna

Additional Authors: Linda Gibson-Young; Amy Pridemore;

Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Hispanic adults living in rural Alabama face persistent barriers to preventive care, including limited clinic availability, transportation constraints, language barriers, lack of insurance, and concerns related to immigration status. Mobile health clinics may help reduce structural barriers and improve engagement in preventive services. This poster will address access for underserved populations with an academic partner community-based mobile health clinic. We assessed whether this increased preventive screening utilization and follow-up adherence among Hispanic adults in Lee County, Alabama. We conducted a community-based, prospective cohort study from January–December 2025 comparing Hispanic adults in rural Lee County with access to a recurring mobile health clinic to a demographically similar group in neighboring areas without mobile clinic access. Participants were recruited through community outreach events, faith-based organizations, and local employers. Need outcome research here. Access to a recurring community-based mobile clinic was associated with higher preventive screening utilization and improved short-term follow-up adherence among Hispanic adults in rural Lee County. These findings support mobile health delivery models as a promising strategy to address preventive care gaps in underserved rural populations.

Title: Effects of enhanced sleep (via activation of Parafacial Zone GABAergic neurons) on memory, anxiety, and depression-like states in mice

Primary Author: Natasha Wendy Grabau

Additional Authors: Daniel Kroeger; Jillian Manville; Tara Flynn; Eva Ortiz-Feder;

Mentor: Daniel Kroeger

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: GABAergic neurons in a specific brainstem region, called the Parafacial Zone (PZ), were recently identified to promote Non-Rapid Eye Movement (NREM) sleep. Since lack of sleep is known to affect behavioral outcomes such as learning/memory, anxiety, and depression, we hypothesized that extra sleep via activation of these neurons would improve behavioral outcomes. To test this hypothesis, we used a technique termed chemogenetics to specifically target GABAergic neurons in the PZ and induce expression of an artificial receptor protein (hM3Dq) in these neurons. Upon binding of the ligand Clozapine-N-Oxide (CNO), hM3Dq-expressing neurons become active. We analyzed EEG/EMG signals from mice after treatment with different concentrations of CNO to determine the optimal dose of CNO for the induction of extra sleep (2.7 mg/kg i.p.). To investigate the effects of sleep on behaviors, we divided our mice into three sleep manipulation groups: 'normal sleep', 'sleep-deprived' and 'extra sleep'. Mice in the 'sleep-deprived' group were kept awake by providing them with new nest material, while mice in the 'normal sleep' group were left to sleep undisturbed. The mice in the 'extra sleep' group received 2.7 mg/kg of CNO to increase sleep. All groups underwent behavioral tests after 4 hours of sleep manipulation: Open Field Test (OFT) for anxiety-like behaviors, Morris Water Maze (MWM) Test for spatial memory, and the Forced Swim Test (FST) for depression-like symptoms. Our results suggest that activation of PZ GABAergic neurons significantly increases NREM sleep, but also suppresses REM sleep, supporting previous findings. Additionally, the behavioral tests indicate that acute increase in NREM sleep (4hrs) may not improve spatial memory, anxiety or depression-like behaviors in mice. Instead, we find that acute sleep deprivation can reduce anxiety and depressive states.

Title: Response to combined Heat Stress and Dehydration within Zebra Finches

Primary Author: Nathan Boudreau-Kim

Additional Authors: Haruka Wada;Margaret McGrath;

Mentor: Haruka Wada

Department/Program: Political Science

College: College of Liberal Arts

Abstract: Physiological responses to heat stress are well studied, yet less is known about how dehydration modifies them. Such interaction may be particularly important for predicting consequences of extreme temperature exposure in animals living in arid environments. To fill this gap in knowledge, we examined the effects of chronic dehydration on physiological responses to non-lethal heat stress in female Zebra Finches (*Taeniopygia guttata castanotis*). Female zebra finches were subjected to eight weeks of progressive water restriction or ad libitum conditions, followed by two consecutive days of three-hour heat exposure at 41.5°C. We then collected blood samples to assess beta-hydroxybutyrate and DNA damage in blood cells. Our findings indicate that neither chronic dehydration nor heat stress alone produced detectable changes in beta-hydroxybutyrate or DNA damage. However, dehydration and heat stress together elevated beta-hydroxybutyrate, whereas DNA damage remained unchanged. The results suggest that dehydration may not increase damage accumulation following heat stress regardless of the elevated metabolic response. These results also imply that zebra finches can withstand both water scarcity and heat stress without long-term negative effects on DNA integrity.

Title: Evaluation of Approaches to Quantify the Effectiveness of the Lead Leg Block in Division I Collegiate Baseball Pitchers

Primary Author: Nicholas Fiorenza

Additional Authors: Benjamin Lerch;

Mentor: Gretchen Oliver

Department/Program: School of Kinesiology

College: College of Education

Abstract: Baseball pitching requires a stable lower extremity to initiate efficient energy transfer through the kinetic chain, ultimately contributing to increased pitch velocity. Following foot contact, the lead leg stabilizes and extends, establishing an effective lead leg blocking position. Traditionally, discrete lead leg metrics, such as maximum lead knee extension velocity, are used to assess the quality of a pitcher's lead leg block, as discrete metrics are easy for coaches and athletes to quickly use in real time. However, a recent time-series analysis from our author group found that the amount of knee extension velocity between 27% to 63% of the time of foot contact and ball release had a stronger relationship with pitch velocity than the maximum value of knee extension velocity. While time-series analysis is likely a more effective way to analyze data than discrete analysis, time-series analysis can be less practical in applied settings than simple discrete metrics. Therefore, our purpose was to use the results of this recent time-series analysis to create a new discrete metric to assess the quality of the lead leg block. Three-hundred and thirty-six National Collegiate Athletic Association Division I baseball pitchers ($1.88 \pm .06$ m; 91.4 ± 10.1 kg; 225 right-handed, 112 left-handed) participated. Kinematic data were collected using an in-game markerless motion capture system. Lead knee extension velocity between the time of foot contact and ball release was interpolated to 101 data points, and the average knee extension velocity value between 27% and 63% of the time frame was used to create a new "Lead Knee Braking Velocity" metric. Linear regression analyses revealed a significant relationship between pitch velocity and Lead Knee Braking Velocity ($r = -0.19$, $p < 0.001$). Additionally, mean maximum lead knee extension velocity prior to ball release was not significantly correlated to pitch velocity ($r = -0.09$, $p = 0.08$). These results highlight the value of time-series analysis in identifying specific kinematic factors that influence pitch velocity—insights that may not be apparent when focusing solely on peak discrete metrics. Athletes seeking to improve pitch velocity are encouraged to incorporate training strategies that emphasize lead leg stability and control during the phases identified in this analysis.

Title: Influence of biochar-herbicide interactions on weed control efficacy in Alabama

Primary Author: Nisith Nishank Purohit

Additional Authors: Andrew Price;Yucheng Feng;Aniruddha Maity;Rakesh Ghosh;

Mentor: Aniruddha Maity

Department/Program: Agronomy and Soils

College: College of Agriculture

Abstract: Pre-emergence herbicides are widely used for early-season weed management; however, their efficacy can be altered by soil amendments such as biochar due to changes in herbicide adsorption and bioavailability. A greenhouse experiment was conducted to evaluate the effect of different biochar application rates on the efficacy of two pre-emergence herbicides recommended in Alabama, pendimethalin and pyroxasulfone (Zidua®). The study followed a two-factor factorial design with biochar rate (2, 5, and 10 t ha⁻¹) and herbicide type applied at the recommended field rate, using two biochar feedstocks, sugarcane and wood. Herbicide efficacy was assessed through germination percentage, seedling dry weight, and total biomass, while herbicide adsorption was quantified using high-performance liquid chromatography (HPLC). Results indicated that increasing biochar rate significantly influenced herbicide performance, with the highest rate (10 t ha⁻¹) resulting in increased germination and seedling growth across both biochar types, suggesting reduced herbicide bioavailability. Sugarcane biochar reduced herbicide efficacy more than wood biochar, likely due to greater herbicide adsorption capacity. HPLC-based residual analysis supported these findings by showing higher herbicide retention in biochar-amended treatments, particularly at higher application rates. Overall, the results demonstrate that biochar rate and feedstock type play a critical role in regulating herbicide behavior in soil, and that excessive biochar application—especially sugarcane biochar—may compromise pre-emergence herbicide efficacy despite potential agronomic and environmental benefits.

Title: Development of biodegradable spray mulch from lignosulfonate, chitosan, and biochar towards sustainable agriculture

Primary Author: Nitesh Kasera

Additional Authors: Hossein Jahromi; Sushil Adhikari;

Mentor: Sushil Adhikari

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Plastic polyethylene mulches are widely used in agriculture but generate persistent plastic residues and require labor-intensive retrieval after use. While biodegradable mulch films have been explored, most rely on precast films and do not adequately address practical application challenges. Sprayable biopolymer solutions that form protective films on soil surfaces offer an eco-friendly alternative to plastic-based mulches and align with sustainable agricultural practices. Therefore, in this work, we report a fully biobased, spray-applied mulch system based on chitosan and lignosulfonate – both beneficial for soil health – that can form an in-situ protective layer on the soil surface. Biochar (10%, 20%, and 30% of the lignosulfonate weight) was also incorporated to further tailor functional performance. The formulation is prepared via room-temperature aqueous processing, eliminating the need for film laying and post-harvest removal. Interactions between lignosulfonate and chitosan enable film formation, while biochar incorporation modulates mechanical behavior, optical properties, and degradation kinetics. The tensile strength of the lignosulfonate-chitosan films ranged from 0.82 to 6.22 MPa, with elongation at break ranging from 6.77% to 27.30%. Biochar addition to the composites increased flexibility and opacity, and the composites effectively blocked UV radiation. The biopolymer formulation with biochar (20% of the lignosulfonate weight) was successfully spray-applied using a commercially available garden sprayer without observable nozzle clogging under the tested conditions, and reduced soil evaporation from 678 to 480 g m⁻² day⁻¹. Tested materials also showed rapid biodegradation, losing more than 40% of their weight during the first 10 days of the experiment. Together, these results demonstrate a practical, spray-applied, and biodegradable alternative to conventional plastic mulches that integrate material design, application strategy, and end-of-life considerations.

Title: Engineering long-acting therapies: Self-forming implants for chronic disease

Primary Author: Nur Mita

Additional Authors: Oladiran Fasina;Xuejia Kang;Manjusha Annaji;

Mentor: Jayachandra Ramapuram

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Long-acting drug delivery systems are needed to improve therapeutic efficacy and patient adherence in chronic diseases. In situ forming implants (ISFIs) provide an approach in which a liquid formulation solidifies after injection, forming a biodegradable drug depot for sustained release. This work evaluates polymer-based ISFIs using two representative applications: a subconjunctival ketotifen fumarate implant for ocular allergy and a subcutaneous capsaicin implant for anti-obesity therapy. ISFIs were formulated by dispersing the drug in polymer solutions containing release retarders and characterized for viscosity, injectability, solidification behavior, morphology, thermal properties, in vitro drug release, stability, and cytocompatibility. Injectability was evaluated using rheological analysis and predicted injection forces, which remained within acceptable limits (<40 N). The ketotifen subconjunctival implant solidified rapidly upon contact with aqueous media and exhibited a triphasic release profile with a low initial burst of $4.91 \pm 0.55\%$, followed by sustained release for up to 4 weeks. Drug recovery exceeded 95%, and cytotoxicity studies using human corneal epithelial (HCE-T) cells demonstrated $>90\%$ cell viability. Scanning electron microscopy revealed a porous, hollow structure, while rheological analysis confirmed shear-thinning behavior. The capsaicin subcutaneous implant showed tunable viscosity and sustained drug release for up to 5 months, following Korsmeyer–Peppas kinetics. Stability studies confirmed formulation stability for 6 months at room temperature, with drug recovery $>96\%$. Cytotoxicity testing using L929 fibroblast cells showed 100% relative cell viability, indicating good biocompatibility. Overall, these results demonstrate that polymer-based self-forming implants can be engineered for predictable, long-term drug delivery across distinct administration routes, supporting their potential as a versatile platform for chronic disease therapy.

Title: Sustainable Leadership and GHRM: Drivers of Motivation, Behavior and Well-being in Chain vs Independent Hotels

Primary Author: Nusrat Jahan

Additional Authors:

Mentor: Imran Rahman

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: Global tourism generates about 6.5% of total greenhouse gas emissions, with hospitality contributing 3% and hotels alone responsible for 1% annually, underscoring the urgency for sustainable operations. As a high-resource and labor-intensive sector, the hotel industry plays a vital role in achieving environmental goals through ethical leadership and strategic human resource management. Employees' attitudes toward environmental issues and engagement are central to implementing green initiatives and attaining sustainability goals. Guided by self-determination and attribution theories, this study will examine motivational factors driving employee participation in green behavior. When intrinsically motivated, employees are more inclined to engage in pro environmental behavior, experience greater well-being, and strengthen their organizational commitment and loyalty. Despite growing recognition of sustainable leadership and GHRM in hospitality, limited empirical attention has been given to the motivational mechanisms linking these constructs, particularly in chain and independent hotels. Addressing this gap, this study contributes to understanding how leadership and HR systems foster authentic environmental engagement and employee well-being, recognizing that these dynamics may differ between chain and independent hotels due to variations in resources, structures and sustainability cultures. Using a quantitative survey method, data will be collected from 500 hotel departmental managers in the U.S. Managers' contact information will be obtained via a database available through the American Hotel and Lodging Association. Theoretically, the study is expected to enrich sustainability literature by linking sustainable leadership and GHRM with employee motivation and behavior through integrated theories. Practically, it will provide insights for hoteliers to implement authentic green strategies that enhance organizational sustainability, employee well-being and agility to shifting consumer demands.

Title: An environmental assessment of food-aid resources at Auburn University

Primary Author: Nyla Duffy

Additional Authors:

Mentor: Onikia Brown

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: National estimates suggest that nearly one in three college students experiences food insecurity, yet stigma and fear of judgment frequently prevent students from utilizing available campus resources. Whether from a general lack of knowledge about these resources, or embarrassment, food insecurity remains a significant yet often unrecognized barrier to academic success among college students. Resources are frequently difficult to locate or underutilized due to lack of awareness. The purpose of this environmental assessment was to systematically identify, document, and categorize food-aid resources available across campus. Research was conducted through building-by-building assessments, consultation of administrators, and a compilation of links to locate possible unknown available resources. These resources were then classified into functional categories including primary food access points, prepared food distribution, grab-and-go options, scholarship or financial support programs. Each location was visually documented and integrated into a campus map using distinct icons to improve clarity and accessibility for students. By consolidating and centralizing this information, the resulting resource tool seeks to increase awareness, reduce stigma surrounding food assistance, and promote timely help-seeking behaviors. Ultimately, this project aims to improve access to essential resources and support student health and academic success.

Title: Rural and urban differences in Alabama pharmacists' beliefs about nalmeferene

Primary Author: Olivia Aycock

Additional Authors: Francesca Mengel;Tori Patterson;Seth Flores;

Mentor: Lindsey Hohmann

Department/Program: Pharmacy

College: Harrison College of Pharmacy

Abstract: This study examined rural-urban differences in Alabama pharmacists' knowledge, beliefs, and intentions regarding nalmeferene nasal spray, an opioid overdose reversal agent. A cross-sectional anonymous online survey informed by the Theory of Planned Behavior was distributed to licensed Alabama pharmacists (n=119). Awareness of nalmeferene was low overall, with fewer than half of respondents having heard of this medication prior to the survey. Objective knowledge scores did not significantly differ between rural and urban pharmacists. Attitudes toward nalmeferene were generally favorable across settings. However, differences emerged in workplace norms and perceived behavioral control. Urban pharmacists reported stronger internal workplace expectations supporting nalmeferene use, whereas rural pharmacists reported greater confidence in their ability to stock and procure the medication. Perceived fiscal and logistical barriers were common across groups. Regression analyses indicated that greater perceived behavioral control and fewer perceived barriers were associated with stronger intentions to stock or recommend nalmeferene. These findings suggest that while pharmacists broadly support overdose prevention efforts, structural and confidence-related factors differ by geographic setting and may influence nalmeferene adoption. Addressing these disparities is particularly important in a state heavily impacted by opioid-related morbidity and mortality. Targeted education and system-level support may improve preparedness and access, particularly in areas with lower normative support or greater operational barriers. Strengthening pharmacist readiness to implement nalmeferene may represent a critical step in expanding equitable overdose prevention resources across both rural and urban communities.

Title: Optimizing motivational interviewing skills for FBT caregivers

Primary Author: Olivia Clancy

Additional Authors: April Smith; Lauren Pictor; Jen Finkelstein;

Mentor: April Smith

Department/Program: Psychology

College: College of Liberal Arts

Abstract: This study reviews the proof-of-concept implementation and modifications to a motivational-interviewing (MI) based training for caregivers of youth receiving family-based treatment (FBT). FBT, the gold standard treatment for youth with eating disorders (ED), requires high rates of parental self-efficacy (SE) as caregivers play a crucial role in treatment. Though parental SE and family functioning (FF) are known correlates of treatment success, no existing intervention targets both in a skills-based format. Additionally, treatment-as-usual does not offer additional support to caregivers, despite their integral role in their child's recovery. To address this, an existing intervention (The School of Hard Talks [SoHT]), which contains didactic content about MI skills, was modified to add psychoeducation about EDs and scenarios relevant to FBT (SoHT-ED). To demonstrate proof-of-concept, caregivers (N=3) were recruited from an outpatient clinic. Measures of caregiver SE and FF were collected pre- and post-intervention, as well as ratings of treatment acceptability and perceived efficacy. At post-treatment, participants provided qualitative feedback. SoHT-ED showed potential as all participants attended each session and completed all assignments. Ratings of acceptability and perceived efficacy were high. While all participants showed improvement in at least one domain of FF declines were also observed, particularly in SE. This suggests the need to further refine SoHT-ED to improve outcomes. Qualitative feedback highlighted themes of appreciation for peer connection, improved communication confidence, and satisfaction with SoHT-ED. Based on feedback and stakeholder review, SoHT-ED was revised to increase focus on SE, expand didactic content, and extend role plays. It is hypothesized that the revised SoHT-ED will increase caregiver SE and improve FF. Doing so has the potential to better equip caregivers for the task of re-feeding and help more youth achieve remission from ED.

Title: Changes in Sense of Purpose as We Age: A Coordinated Data Analysis of Seven Longitudinal Studies

Primary Author: Olivia Duchow

Additional Authors: Gabrielle Pfund;

Mentor: Gabrielle Pfund

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Sense of purpose is defined as the extent to which individuals perceive their lives as having direction, goals, and meaning. Healthier outcomes through the aging process, including slower cognitive decline, lower risk of cardiovascular disease, reduced mortality risk, and less allostatic load. However, despite its importance for age-based outcomes, the trajectory of purpose across the lifespan remains understudied. In this pre-registered work, we examined age-related trajectories of sense of purpose using coordinated data analysis (CDA) across seven longitudinal studies: Health and Retirement Study (N=13,846), Midlife in the United States (N=4,026), Rush Memory and Aging Project (N=1,880), Rush Minority Aging Research Study (N=693), Rush Latino Core (N=222), Wisconsin Longitudinal Study- Graduates (N=6,737), and Wisconsin Longitudinal Study- Siblings (N=3,806). CDA uses raw data from individual studies to test the same research question across multiple datasets. Participants reside across the United States, come from diverse background, and reported on their sense of purpose levels across years to decades. These strengths enable the examination of purpose development within adults over time across a wide range of individuals. To understand why individuals' trajectories on purpose may differ as they age; we incorporated demographic and health covariates including race, gender, education, relationship status, and health conditions. Using a CDA approach, this study used multilevel linear and quadratic growth models with random slopes to characterize how sense of purpose changes as individuals age across diverse American populations. Sense of purpose tends to increase and peak in middle adulthood, before declining later in life. Thus, highlighting the vulnerability of older adults to maintain a sense of purpose. Findings inform the importance of future intervention development aiming to promote purpose as people experience older adulthood's unique life transitions.

Title: Translating cognitive processes: comparing age-related change in memory performance across humans and macaques

Primary Author: Olivia Norwood

Additional Authors:

Mentor: Christine Charvet

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Humans show age-related variation in memory performance. Macaques are often used to study human aging, but it is not clear whether macaques experience similar patterns of cognitive aging as humans do. Establishing common patterns of cognitive change across humans and macaques would establish macaques as relevant models for human aging. We aim to test whether macaques experience similar cognitive changes to humans across postnatal ages. We used results collected from the ManyPrimate group, which consists of a series of cognitive tests conducted on long-tailed macaques (*Macaca fascicularis*), lion-tailed macaques (*Macaca silenus*), rhesus macaques (*Macaca mulatta*), and tonkean macaques (*Macaca tonkeana*). These data are collected across a wide age range (age range: 1.2-29 years). The macaques were shown three cups, one of which contained a food reward inside. Macaques could then reach to either cup 0, 15, or 30 seconds after being shown the location of the food reward. Correct and incorrect responses were recorded. We fit a smooth spline to model the relationship between performance versus age, which showed an age-related peak in memory performance in macaques. This pattern is similar to humans. We use data from the Translating Time, which contains 1,167 observations across humans and macaques, to generate age alignments across postnatal ages in humans and macaques (e.g., a 2.5 year old rhesus macaque translates to a 10 year old human) and to evaluate how age-related changes in memory performance in macaques compare to humans once overall changes in the pace of development and aging are accounted for. These results may inform how to compare cognitive changes in humans and macaques.

Title: Using a theatre-based approach to enhance vaccine confidence among older adults

Primary Author: Oluchukwu Maureen Ezeala

Additional Authors: Salisa Westrick; Lena McDowell; Tessa Carr; Abdul-Khaliq Murtadha;

Mentor: Salisa Westrick

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Vaccines have been proven to be one of the most effective ways to prevent vaccine-preventable diseases and save lives. Statistics show that uptake of most vaccines recommended for older adults by the U.S. Centers for Disease Control and Prevention is suboptimal. Evidence suggests several contributing factors, including limited awareness and knowledge of recommended vaccines, and concerns about vaccine safety and effectiveness. While traditional educational methods such as fact sheets and flyers have been used to address these issues, there is a need to explore innovative methods that are more effective and engaging. This study assessed a community-based educational intervention that used a theatre play to improve vaccine confidence among older adults. Semi-structured interviews were conducted with 11 seniors to understand their perceptions and barriers & facilitators to vaccination, and the findings were used in the development of a play script. The play has been delivered at two community centers in Alabama- Greater Peace Church, and Osher Lifelong Learner Institute, with an upcoming delivery at Opelika Sportsplex. Pre and post-surveys were used to assess changes in knowledge, intention to discuss vaccination with family and providers, and opinions on the use of theatre play as an educational tool. Preliminary findings show that 64 participants took part in the study. Among those who provided complete responses, the mean age was 72.9 ± 7.9 years, and most were female (74.1%). McNemar–Bowker tests indicated statistically significant pre-post changes on four of the six knowledge items ($p < .05$). Wilcoxon signed-rank tests showed significant increases in participants' likelihood of discussing vaccine needs with family ($p = .003$) and pharmacists ($p = .033$) after the intervention. Most described the performance as informative, engaging, and entertaining. Findings from this study will inform the expansion of this program to under-vaccinated populations in Alabama.

Title: Spatial and Temporal Assessment of Temperature Variability in Tunnel Ventilated Commercial Broiler Houses

Primary Author: Olumide Babatope Falana

Additional Authors: Bethany Baker;Zhaofei Fan;Jeremiah Davis;John Linhoss;

Mentor: John Linhoss

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Indoor temperature variation in commercial broiler houses can expose broilers to thermal stress, adversely affecting performance and welfare. This study quantified spatial and temporal temperature variability in four 18.3 × 182.9 m tunnel-ventilated commercial broiler houses during spring and late summer grow-out periods. Temperature was recorded at 5-min intervals from 77 locations per house. Temperature variability was evaluated using the coefficient of variation (CV), with the effects of house and season assessed using a generalized linear mixed model and day treated as a random effect. Sensors were grouped into 11 longitudinal cross-sections from the cooling pad to the tunnel fan end to assess spatial patterns. Mean temperature CV did not differ among houses ($P > 0.05$), but season significantly affected CV ($P < 0.01$), with higher variability observed in spring (6.64%) than late summer (5.78%). Daily CVs ranged from 2.7 to 14.1% and were strongly associated with outdoor conditions. Spatial analyses indicated increasing temperature variability with bird age in both seasons, likely due to increased metabolic heat production. During late summer, temperature CV increased consistently from the pad to the fan end, whereas no consistent longitudinal trend was observed in spring. These results demonstrate that seasonal conditions, bird age, and longitudinal position within tunnel-ventilated houses are primary drivers of in-house temperature variability.

Title: Ploidy manipulation of underutilized Asiatic cotton (*G. herbaceum*) to rapidly produce fertile F1 hybrids with upland cotton (*G. hirsutum*)

Primary Author: Orrie Feitsma

Additional Authors: Jinesh Patel;Jenny Koebernick;

Mentor: Jenny Koebernick

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Upland cotton (*Gossypium hirsutum*) is an economically important fiber crop in the US. Although modern cultivars are high yielding, their limited genetic diversity makes them susceptible to various pests and diseases which can result in significant costs and yield loss for growers. *Gossypium herbaceum* is an A genome diploid species with high genetic diversity and significant resistance to some pests and diseases such as sucking insects and leaf-curl viruses. The most commonly utilized methods for transferring valuable genes from A genome species such as *G. herbaceum* to upland cotton have a low success rate and are very time and labor intensive. In this study, we treated *G. herbaceum* seeds with 0.1% colchicine to produce a single plant which, when used as a female, was able to easily hybridize with multiple *G. hirsutum* lines to produce fertile F1 hybrids. Using flow cytometry, the F1 progeny from the crosses were confirmed as tetraploids. Phenotypic traits and SSR markers were used to confirm that the F1s were true hybrids, and an acetocarmine pollen grain staining technique was used to confirm the fertility of the hybrids. Backcrosses to *G. hirsutum* were made using the F1 hybrids as a female parent. Germination of a BC1 seed was successful, and research to confirm and utilize this hybrid is currently ongoing. The method of ploidy manipulation described in this study can be applied to multiple accessions of underutilized *G. herbaceum* to more efficiently transfer valuable traits to upland cotton in the future.

Title: How data structure influences the selection of clustering methods

Primary Author: Osama Abu-Farsakh

Additional Authors: Casey Eaton;

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Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: Clustering algorithms are widely used to group observations, identify patterns, and support decision-making in complex datasets across engineering and scientific domains. For example, clustering algorithms have been used to segment customers, group stakeholders with similar preferences, and identify patterns in healthcare data. Selecting the best clustering algorithm for a specific dataset remains challenging. The performance of distance-based and similarity-based approaches depends on the characteristics and structure of the data. However, limited guidance is available on the conditions under which a clustering method may show advantages over the others. This study compares a developed Grey Relational Analysis Hierarchical Clustering (GRA-HC) with K-means, Ward's method, and average linkage using multiple benchmark datasets with multiple levels of attributes, degree of correlation between attributes, and number of clustering groups based on clustering validity indices (CVI). The results suggest that high correlations among attributes may negatively impact the performance of GRA-HC, and this effect becomes significant as the number of attributes increases. The GRA-HC appeared competitive agreement with true class labels on the Iris dataset with ARI = 0.7184 and achieved the best performance on the E. coli dataset with ARI= 0.7156, better than K-means (ARI= 0.4265), Ward's method (ARI= 0.3993) and average linkage heuristic (ARI= 0.6579). On the other hand, the Wisconsin Breast Cancer dataset with strong multicollinearity ranged between 0.96 and 0.99 across 30 attributes, distance-based clustering such as K-means and Ward's maintained clearer separation, while GRA-HC showed low discriminative capability and a large number of observations compacted into one dominant cluster. Overall, the results concluded that the performance of similarity-based and distance-based clustering algorithms is influenced by the degree of correlation between attributes in the dataset and the number of attributes. These findings provide practical guidance for clustering method selection and highlight the importance of data structure when selecting a clustering approach.

Title: Cable degradation and making a predictive model

Primary Author: Owen Lucas

Additional Authors: Pradeep Lall;

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Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Flexible cables are essential components in robotic and underwater electronic systems, often required to operate under repeated mechanical stress, multidirectional movement, and exposure to harsh environmental conditions. Over time, these factors contribute to material fatigue and degradation, which can compromise system performance and increase maintenance needs. This research presents a data-driven approach for assessing and predicting cable health through the development of a predictive model in collaboration with an industry partner. Multiple non-destructive measurement techniques are employed, including S11 reflection coefficient data measured using a vector network analyzer, resistance measurements obtained from a digital multimeter, and FFT trace data provided by proprietary diagnostic equipment from AVNIK Defense Solutions. From these measurements, key features such as standard deviation, peak frequency shift, and additional signal-based characteristics are extracted to capture changes associated with corrosion-induced degradation. These features are combined to generate a quantitative State of Health metric representing the condition of the cable. A Gaussian Process Regression model is then applied to relate the extracted features to cable health and enable predictive estimation of future degradation trends. These proposed methods demonstrate the potential for integrating multi-modal electrical measurements with probabilistic machine learning techniques to support cable health monitoring and predictive maintenance in harsh marine environments.

Title: Demonstrating the utility of immersive analytics for magnetosphere modeling

Primary Author: Ozo Kasahara

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Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Scientists need to decide if the amount, quality, and variety of data collected are sufficient to meet a study's goals and answer its research questions. Experts in space mission design refer to this problem as data sufficiency. As noted in the 2020 JPL study, "Broadening JPL's Mission Formulation Paradigm with Human Centered Design", in the field of space systems engineering, a primary bottleneck in early-stage mission design is the significant human labor required to mature a Science and Mission Concept of Operations (CONOPS). Virtual Reality (VR) is one way to facilitate analytical thinking and ease the complexity of space mission design. This research investigates the application of immersive analytics, using Unity as an insight engine, to understand particle dynamics in Earth's magnetosphere, rendered with a tilted dipole model. Our solution is implementing a phenomenological model with real-time validation and customized sub-stepping. We designed the architecture to support interactive parametric studies, such as real-time specific charge tuning and sub-step tuning, allowing researchers to observe how varying these parameters influences drift direction and trapping stability within the validated numerical window. While Unity's optimized default of a 50 Hz physics frequency for standard interactions, it can cause numerical instability when integrating an acceleration through a rapidly changing magnetic field. Validation was conducted by monitoring the conservation of the first adiabatic invariant (magnetic moment). The magnetic moment was normalized by omitting the constant mass and scalar coefficients for computational efficiency. Comparing the percent deviation for 60 seconds in the different numbers of sub-steps revealed the numerical stability window. Percent deviations for no sub-steps (default), 50 sub-steps, and 1000 sub-steps are about 700%, 45%, and 210%, respectively. The default case exhibits significant numerical instability due to insufficient temporal resolution. The case with 50 sub-steps achieved <10% error at magnetic mirror points, where longitudinal velocity reverses. Conversely, the 1,000 sub-step case indicates a performance-induced real-time violation. The resulting deviation is a combination of floating-point accumulation and computational latency, resulting in execution time exceeding the fixed timestep and a mismatch between the physical integration and the simulation clock. This research bridges the gap between high-fidelity but inaccessible supercomputers and accessible but unvalidated educational tools. Users can understand and investigate nonlinear plasma interactions within a validated environment, with a real-time validator that roots insights in numerical stability and authentic plasma dynamics.

Title: Functional communication training to reduce attention-maintained challenging behavior in a young girl with down syndrome

Primary Author: Paige Loyacono

Additional Authors: John Falligant;Hastings Sears;

Mentor: John Falligant

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Children with developmental disabilities often engage in challenging behaviors such as self-injury, aggression, or disruption to get attention from adults or peers. These behaviors can make teaching and appropriate social interactions difficult. Functional communication training (FCT) was used to teach a young girl with Down syndrome an alternative way to request attention, rather than relying on unsafe or disruptive behaviors. During baseline conditions, the client frequently engaged in challenging behavior when attention was withdrawn. Therapists implemented an attention-based FCT protocol that used prompt-delay, modeling, and systematic prompt fading to teach the client to tap the therapist as an alternative method to request attention. Across phases, the data showed a shift from full-physical prompting to predominantly independent communication, while levels of challenging behavior were consistently low. These results suggest that the FCT procedure effectively replaced reliance on problem behavior in order to garner attention, instead using appropriate communication that can be used across everyday routines. These findings support the use of individualized, function-based communication interventions to guide future therapeutic efforts aimed at reducing challenging behavior while increasing independent, socially appropriate communication in children with developmental disabilities.

Title: Environmental and Microbial Signals Drive Type VI Secretion System Activation in a Foliar Plant Pathogen

Primary Author: Palash Ghosh

Additional Authors: Mason Pearce;Destiny Brokaw;

Mentor: Neha Potnis

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The Type VI Secretion System (T6SS) is a contractile nanomolecular machine used by Gram-negative bacteria to deliver effector proteins into neighboring cells, mediating interbacterial competition and host colonization. While *Xanthomonas perforans* (Xp) a devastating pathogen of tomato and pepper possesses two distinct T6SS clusters (i3*** and i3*), their role in the competitive phyllosphere microbiome remains unclear. Using GFP-based transcriptional reporters of T6SS, we demonstrated that Xp employs T6SS to detect threats from phyllosphere isolates present on surface of tomato. This activation of T6SS is also expressed at low levels for baseline defense and it is selectively upregulated upon contact with specific Gammaproteobacteria isolates. Structural modeling further revealed that the Xp-Tai4 immunity protein retains a conserved fold despite significant sequence divergence from homologs. Functionally, we show that the i3* cluster is indispensable for Xp fitness; mutants lacking a functional apparatus (tssM mutant) exhibit a marked survival disadvantage when challenged by T6SS-armed competitors, including *Serratia ureilytica* and *Enterobacter kobei*. Additionally, Xp modulates T6SS activity in response to abiotic stressors like pH and salinity. Collectively, our results suggest that Xp integrates biotic and abiotic cues to prioritize its antibacterial arsenal, ensuring competitive dominance and persistence within the host phyllosphere.

Title: Targeting Luteinizing Hormone as a Novel Therapy for Polycystic Ovary Syndrome

Primary Author: Paschall McDaniel

Additional Authors: Aime Johnson;Arthur Zimmerman;

Mentor: Douglas Martin

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Polycystic ovary syndrome (PCOS) is a complex and poorly understood endocrine and metabolic disorder affecting an estimated 20% of women worldwide. Hallmark characteristics of PCOS are polycystic ovaries, irregular menstrual cycle, anovulation, insulin resistance, hyperandrogenism, and an elevated luteinizing hormone (LH) to follicle stimulating hormone (FSH) ratio. Recent studies divide PCOS into two primary subtypes, lean and obese, based on body mass index (BMI). However, it remains unclear how these subtypes differ in disease progression and how to differentiate the subtypes at diagnosis. While underlying etiology differs, lean and sometimes obese PCOS can be characterized by dysregulation of gonadotrophin-releasing hormone (GnRH) secretion. GnRH is secreted in a pulsatile manner resulting in production and release of the pituitary gonadotropins, LH and FSH. In lean PCOS, GnRH secretion exhibits increased pulse frequency and amplitude, favoring LH over FSH and resulting in an increased LH/FSH ratio. Increased LH with lean PCOS is the primary driver for much of the disease pathophysiology, and, therefore, elevated LH provides a primary target for therapeutic intervention. Currently, there are few treatments for PCOS and most of them are effective only for obese PCOS. For lean PCOS, contraceptives and anti-androgen agents may be used for hyperandrogenism and menstrual irregularities, but this is not a long-term solution for women who desire to become pregnant. Therefore, there is a critical need for alternative therapies for lean PCOS to control symptoms and/or alter disease state. Here, we test an anti-LH antibody that lowers serum LH without disrupting reproduction as a novel therapeutic in a mouse model of lean PCOS. Given high LH levels and an increased LH/FSH ratio in lean PCOS are primary drivers for PCOS symptoms, we hypothesize anti-LH antibody treatment will normalize the LH/FSH ratio, maintain reproductive viability and correct disease features.

Title: Beer with a purpose: Shaping beer preferences with local ingredients and upcycled brewing byproducts

Primary Author: Pathmanathan Sivashankar

Additional Authors: Samir Huseynov; Wendiam Sawadgo;

Mentor: Samir Huseynov

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: The growing interest in localism and sustainability is reshaping consumer preferences in the U.S. craft beer market, presenting opportunities for agricultural producers and brewers. This study investigates consumer willingness to pay (WTP) for beer brewed with locally sourced hops and barley, as well as the influence of upcycling certifications that highlight recycling of brewing byproducts. Using a national survey of 1,150 beer consumers, we employed a binary choice experiment with three informational treatments - neutral, economic, and environmental to assess how messaging and demographics shape preferences. Preliminary findings indicate that informational treatments alone did not significantly affect WTP. Instead, demographic and behavioral factors played a stronger role. Younger consumers consistently expressed higher WTP, while frequent drinkers and individuals unfamiliar with Sweet Grown Alabama (SGA) initiatives reported lower WTP. Regional differences emerged: in Alabama, higher education, white ethnicity, and beer-related expenditure were positively associated with WTP, while middle-income respondents and those unfamiliar with SGA were less supportive. In contrast, outside Alabama, drinking frequency and age were more influential. These findings highlight the limited role of nudges compared to consumer characteristics and regional context, offering brewers actionable insights into market segmentation, product positioning, and the potential of local certification programs.

Title: Development of a haptic simulation of joint stiffness in Rheumatoid Arthritis

Primary Author: Paxton Albright

Additional Authors: Chad Rose;Missie Smith;Kimberly Garza;

Mentor: Chad Rose

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Effective chronic disease management requires patients to engage in sustained behavior change despite delayed benefits and abstract future consequences. In rheumatoid arthritis (RA), early and consistent treatment can prevent irreversible joint damage, yet patients may struggle to envision the lived experience of disease progression. This disconnect reflects a broader challenge in health education: fostering empathy for one's future self. Immersive technologies offer a promising solution. Virtual reality (VR) combined with haptic feedback can enable embodied experiences that make future health states more tangible. This project introduces the semi-Passive INternal Stiffness Simulation Robot (PINSSR), a first-of-its-kind wearable robot that varies the friction applied to a series of push-pull tendons to dynamically change the damping that is applied to the user's fingers. When combined with visual motor distortion in VR, this device simulates the stiffness of RA. A psychophysical experiment with ten healthy adults at least nineteen years of age was used to determine the best configuration of physical damping and visual pseudo-haptic effects to mimic RA like joint stiffness. This experiment utilized the Adaptive Experimentation in Psychophysics (AEPsych) framework which uses nonparametric Gaussian Process models to determine each user's perceptually informed preference for the joint stiffness of RA. An embodiment scale was used along with semi-structured interviews to ascertain the system's ability to instill empathy for one's future self in participants. Results show the configuration that is able to reasonably produce RA like joint stiffness based on the participant population.

Title: Phenotypic and molecular characterization of metal resistance in soil microbes

Primary Author: Pierce Meinert

Additional Authors: Isaiah Fowler; Liam Brown;

Mentor: Michelle Gibbs

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The soil microbiome is a diverse and vital community of organisms that aid in necessary processes like nutrient cycling, digestion of organic molecules, and improvement of soil fertility. The association between soil microbes and plants have many applications for agricultural practices. Many commercial fertilizers include metal micronutrients (Cu^{2+} , Zn^{2+} , Mn^{2+} , and Fe^{2+}) to support plant growth, but the effect of these metals on the bacteria themselves is understudied. We want to assess how the soil microbiome responds to these metals with an emphasis on how the ribosome is directly impacted and possible mechanisms it uses to alleviate the stress. Also, because the ribosome incorporates metal ions like zinc and magnesium into its structure, we hypothesize that it directly senses metal stress and responds to it. I cultivated 132 bacterial isolates from three plots: ones fertilized with macronutrients (K, P, S, N), macronutrients and micronutrients, and plots with no soil amendments. Using 16S rRNA sequencing and phylogenetic analyses, I identified roughly 40 unique species from 17 different genera including *Chryseobacterium*, *Stenotrophomonas*, *Bacillus*, and more. Since the main objective was to observe the phenotypic effect of metals on the bacteria and their ribosomes, I characterized cellular responses to zinc in twenty isolates. From my analysis, I categorized the isolates based on the observed growth defect, finding metal resistance, sensitivity and a more concentration dependent growth defect in. Preliminary sucrose gradient density ultracentrifugation to assess relative levels of ribosomal components have shown little to no effect on the actively translating ribosomal abundance in the organisms I found to be metal resistant. This research demonstrates how commercial fertilizers might be harming the soil microbiome and raises questions about potential mechanisms the ribosome uses to combat metal stress.

Title: How many minutes is your city? Analyzing walking access to amenities in Montgomery, Al

Primary Author: Pourya Kabirkoohi

Additional Authors: Binita Mahato;

Mentor: Binita Mahato

Department/Program: Department of Political Sciences and Public Administration

College: College of Liberal Arts

Abstract: This study examines pedestrian infrastructure through a walkability-focused model in Montgomery, Alabama, with a particular emphasis on accessibility. In the context of the United States, zoning policies have historically enforced spatial separation, resulting in increased time expenditures necessary for accessing essential services. Enhancing walkable access has the potential to foster social interactions, reduce greenhouse gas emissions, and improve public health outcomes. Empirical research indicates that neighborhoods characterized by higher income levels and predominantly White populations generally exhibit superior pedestrian access, while lower-income and minority communities experience pronounced deficits in walking infrastructure. This disparity underscores the notion that planning efforts concentrated solely on proximity may inadvertently exacerbate existing social inequalities. Utilizing Geographic Information Systems (GIS)-based network analysis, this study evaluates walk-based access to points of interest (POIs) essential for daily needs, in relation to the current availability of sidewalks. The findings are juxtaposed with an idealized pedestrian network that incorporates all walkable streets while excluding highways and other high-speed thoroughfares unsuitable for pedestrian infrastructure. Accessibility outcomes are analyzed spatially and through demographic factors, including age, income, race, and vehicle ownership, to delineate both served and underserved populations. By correlating the modeled accessibility with travel behavior patterns, this research offers actionable insights for policymakers, informing targeted investments in pedestrian infrastructure aimed at effectively addressing inequities in access to essential services.

Title: How are Unmanned Aerial Vehicles (UAVs) Revolutionizing Forest Operations? A Systematic Review of Current Applications and Future Opportunities

Primary Author: Prakash Ojha

Additional Authors: Lana Narine; Brian Via; Richard Cristan;

Mentor: Jo Daniel

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The use of unmanned aerial vehicles (UAVs), or drones, in forest operations has increased significantly, with applications ranging from rut and deformation mapping and canopy and gap analysis to road geometry and stockpile/woodchip volume calculations. However, no comprehensive reviews have synthesized the use of UAVs in forest operations. Here we present a systematic review of 48 studies (2015-2025) on UAV use in harvesting, logging, site preparation, and forest roads. PRISMA guidelines were used to collect and analyze the literature from the Web of Science (WoS) and Scopus databases. The review reported five major forest operation domains, among which soil disturbance and erosion management received the greatest number of studies, followed by forest harvesting and impact monitoring, whereas UAVs are least commonly applied to forest roads and infrastructure, which remains comparatively understudied. Most studies used multirotor UAVs such as DJI Phantom 4 Pro equipped with RGB sensors, with Agisoft Metashape being the most common image processing software. Overall, UAV-based methods have been reported to be more efficient, accurate, and cost-effective than traditional surveys. Key limitations include limited battery life, susceptibility to obstacles, and longer processing times. Since 2020, the use of UAVs has increased significantly, peaking in 2023, with the United States and Croatia contributing the most publications. The integration of UAV images with advanced technologies, such as artificial intelligence, is emerging and offers new opportunities for operational monitoring and decision support. Our findings demonstrate that UAVs are essential tools for forest operations, although further technological advancements and improvements are necessary to enhance their effectiveness and overcome current limitations.

Title: Development and characterization of biochar modified chitosan films for sustainable packaging solutions

Primary Author: Pravalika Boini

Additional Authors:

Mentor: Sushil Adhikari

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The growing environmental concerns associated with plastic waste have intensified the search for biodegradable and sustainable alternatives. This research focuses on the development of chitosan-based composite films reinforced with pine-derived biochar for potential use in packaging applications. By systematically varying the biochar content (10–50%), the films were tailored to enhance functional performance while maintaining biodegradability. Extensive material characterization was conducted, including tensile strength, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and permeability to water vapor, oxygen, and air. Results revealed that biochar incorporation significantly improved the films' thermal stability, mechanical integrity, and barrier properties, demonstrating their potential as eco-friendly alternatives to conventional plastics. Looking ahead, the incorporation of ionic liquids as green plasticizers is proposed to further improve film flexibility, homogeneity, and processability without compromising environmental safety. This future direction aims to advance the design of high-performance biodegradable packaging materials by combining the benefits of bio-based fillers and sustainable plasticizers. This study contributes to the broader goal of a circular economy by valorizing agricultural residues and natural polymers into functional materials. By advancing biodegradable film technologies, the work supports the transition toward environmentally responsible packaging solutions and opens pathways for future integration of renewable additives and green chemistry principles.

Title: Comparative Evaluation of Host Preference and Reproductive Performance of *Bemisia tabaci* on Cotton and Selected Aromatic Herbs

Primary Author: Priya Shahi

Additional Authors: Neilly Cope;

Mentor: Paulo Gimenez Cremonez

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: *Bemisia tabaci* is a notorious sap-sucking pest that causes serious damage to cotton and other crops, leading to significant yield losses and heavy reliance on chemical insecticides. However, intensive insecticide use has resulted in resistance development and environmental concerns, highlighting the need for sustainable management strategies. Some aromatic herbs produce volatile compounds that can repel whiteflies. This study evaluated the host preference of *B. tabaci* between cotton and three aromatic herbs (basil, mint, and sage) under controlled laboratory conditions. Bioassays were conducted with 30 replicates per herb. In each replicate, one cotton leaf and one herb leaf were confined in a container, with their undersides (oviposition sites) exposed to 15 pairs of adult whiteflies. After a fixed oviposition period, eggs and nymphs on each leaf were counted under a microscope. Whitefly densities (eggs and nymphs per leaf) on cotton versus each herb were compared using Wilcoxon signed-rank tests. Whitefly egg and nymph densities differed significantly among host plants, with basil, mint, and sage consistently supporting lower populations than cotton. The analysis showed significantly reduced egg and nymph counts on basil (eggs: $p=0.00049$; nymphs: $p=1.2$), mint (eggs: $p=0.0013$; nymphs: $p=0.0025$), and sage (eggs: $p=0.0016$; nymphs: $p=0.00059$) compared to cotton. These results indicate that all three herb species negatively affected whitefly reproduction and immature development relative to the cotton host. In conclusion, incorporating such herbs into cropping systems as intercrops could help reduce whitefly infestations.

Title: Are interstates more safer and efficient for log truck transportation: A statewide route analysis in Alabama

Primary Author: Puspa Raj Joshi

Additional Authors: Lana Narine;Adam Maggard;Jo Daniel;Richard Cristan;

Mentor: Richard Cristan

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Alabama holds massive amount of forest resources with over 23 million acres of timberland making it the 3rd largest commercial forest in the United States. Given this vast amount of forest resources, Alabama is home to more than 110 wood processing facilities that play a great role in state's economy. Log trucks play a vital role in survival of these forest based industries by supplying unprocessed timber from harvesting sites. Log trucks rely on state and county roads most of the time due to flexibility to carry more weight compared to interstate highways. Maximum log truck capacity is 88,000 lbs. including (+10% tolerance) on state and county roads. However frequent and fatal log truck crashes also occur more frequently along state and county roads. On the other hand, interstates are known to have a lower fatal crash risk, but log trucks tend to avoid them because they are restricted to 80,000 lbs. Interstates have better design standards that have a median barrier which separate opposite direction traffic reducing the likelihood of head on collisions and absence of road intersections, which are in abundance on state and local roads and often the source of log truck accidents. Also, interstates have higher design standards and the ability to support higher Gross Vehicle Weight (GVW). Further, the streamlined traffic flow and higher travel speed would allow logging businesses to send an extra timber on a log truck to mills requiring fewer log trucks on the road, while helping resolve the issue of ongoing nationwide shortage of log truck drivers. Using ArcGIS Pro's network analysis and route optimization technique, this study provides valuable insights into the safety and efficiency of using interstate highways with increased GVW (80,000 lbs. + 10% tolerance), for log truck transportation. Given significant benefits of interstate travel if log trucks could use interstates more freely, it could improve both safety and efficiency in Alabama's forest transportation sector.

Title: Pathogenicity, cytopathic effects, and S1 gene diversity of avian reoviruses circulating in Alabama poultry

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Department/Program: Poultry Science

College: College of Agriculture

Abstract: Avian reovirus (ARV) is an economically important poultry pathogen associated with tenosynovitis, malabsorption syndrome, and immunosuppression. However, limited information is available on the pathogenicity and genetic diversity of ARV strains currently circulating in Alabama poultry flocks. This study evaluated the pathogenicity, in vitro cytopathic characteristics, and genetic diversity of ARV field isolates circulating in Alabama during 2019, with genetic analysis based on S1 gene encoding surface glycoprotein σ C. Eleven ARV isolates from the Thompson Bishop Sparks State Diagnostic Laboratory were propagated in specific pathogen-free embryonated chicken eggs to assess pathogenicity. The isolates exhibited variable pathogenicity, including differences in embryo mortality, growth suppression, and hemorrhagic manifestations. For in vitro characterization, isolates were propagated in avian QM5 and DF-1 cell lines, where they induced cytopathic effects, including cell rounding, syncytium formation, cytoplasmic vacuolation and monolayer detachment. Phylogenetic analysis of partial S1 (σ C) gene sequences revealed substantial genetic diversity among the isolates. The majority isolates clustered within genotypic cluster II (GCII), forming multiple distinct subclades, indicating intra-genotypic variability. These isolates were genetically distinct from commonly used vaccine strains, which clustered within GCI. In addition, a subset of isolates grouped with other genotypic clusters, including GCIII and GCV, suggesting the co-circulation of multiple ARV genotypes. Overall, these findings demonstrate considerable pathogenic and genetic heterogeneity among circulating ARVs in Alabama poultry flocks and highlight potential antigenic differences from vaccine strains. Further studies, including whole-genome sequencing and virus neutralization assays, are needed to define genomic relationships and antigenic relatedness between field isolates and current vaccines.

Title: Automated Identification of Visually Similar Construction Materials Using Robotic Hyperspectral Imaging

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Additional Authors:

Mentor: Eric Wetzel

Department/Program: McWhorter School of Building Science

College: College of Architecture, Design and Construction

Abstract: Accurate identification of construction materials is fundamental to effective progress tracking, quality control, and automated decision-making in the built environment. Conventional inspection methods remain heavily dependent on manual visual assessments and RGB-based imaging systems, which are inherently limited in their ability to distinguish between materials that appear similar. This limitation becomes particularly problematic in modern construction projects, where visually similar materials such as drywall with different coatings, primers versus finish paints, or protective surface treatments must be differentiated reliably to support automated progress measurement, percent-complete estimation, and quality assurance workflows. Hyperspectral imaging (HSI) is an emerging sensing technology that offers a promising alternative to conventional imaging techniques by enabling material identification based on unique spectral signatures rather than surface appearance alone. Unlike traditional RGB imaging systems, which compress spectral information into three broad color channels, HSI captures hundreds of narrow and contiguous spectral bands across the visible, near-infrared (NIR), and short-wave infrared (SWIR) regions. This fine-grained spectral resolution preserves subtle reflectance variations that arise from differences in material composition, surface treatments, and coatings. As a result, HSI enables the identification of unique spectral fingerprints that allow materials to be distinguished even when they appear visually identical to the human eye or to conventional cameras. Prior research in domains such as agriculture, manufacturing, cultural heritage conservation, and remote sensing has demonstrated the effectiveness of HSI for material discrimination under controlled conditions. However, the application of hyperspectral imaging within construction environments remains limited, particularly with respect to mobile deployment, robotic integration, and real-time field validation. Construction sites present a uniquely challenging operational context for advanced sensing technologies. They are characterized by variable and often uncontrolled lighting conditions, airborne dust, mechanical vibration, occlusions, and dynamic spatial layouts. These factors complicate both spectral data acquisition and interpretation, and they limit the direct transfer of hyperspectral techniques developed in laboratory or industrial settings to real construction environments. Furthermore, existing construction automation and progress tracking systems rely predominantly on RGB imaging, LiDAR, or manual inspection, all of which struggle to differentiate visually similar materials. As construction projects continue to increase in complexity and scale, there is a growing need for intelligent sensing systems that can operate autonomously, reliably, and non-destructively under real site conditions. This doctoral research addresses these challenges by designing, developing, and validating a robotic hyperspectral imaging system tailored specifically for construction applications. The primary focus of the research is the automated identification of visually similar construction materials to support progress tracking and percent-complete estimation. By integrating a hyperspectral imaging sensor with a mobile robotic platform, the study aims to enable

autonomous, repeatable, and in-situ material identification across large construction environments. The research combines hyperspectral sensing, robotic mobility, and machine learning-based classification to advance both theoretical understanding and practical implementation of intelligent sensing systems in the built environment. The research adopts a phased, mixed-method experimental framework that progresses systematically from foundational analysis to controlled experimentation and real-world field validation. The first phase consists of a comprehensive qualitative literature review that synthesizes existing research on hyperspectral imaging principles, robotic sensing in construction, material identification methods, and spectral data processing techniques. This review maps current capabilities and limitations while identifying critical research gaps related to sensor payload design, environmental robustness, illumination sensitivity, data synchronization, and algorithm selection for construction-specific applications. Particular attention is given to the shortcomings of RGB-based progress tracking systems when applied to visually similar materials, highlighting the need for spectrally informed approaches. The second phase involves a pilot experimental study conducted in a controlled laboratory environment using a Living Optics hyperspectral camera. This phase focuses on establishing baseline spectral separability and classification accuracy for visually similar construction materials. Drywall samples with different surface coatings are used as representative test cases, reflecting common challenges encountered in construction progress tracking. Controlled illumination conditions are employed to isolate material-specific spectral characteristics and to evaluate the influence of lighting variability on classification performance. Data preprocessing techniques include sensor calibration, illumination normalization, and dimensionality reduction methods such as principal component analysis (PCA) and band selection. These steps are used to reduce noise, mitigate redundancy in high-dimensional spectral data, and enhance class separability. Classification is performed using both machine learning and deep learning approaches. Traditional machine learning models, including support vector machines (SVM) and random forest (RF) classifiers, are evaluated alongside deep learning architectures such as convolutional neural networks (CNNs). Cross-validation is employed to assess robustness and generalization performance. The pilot study results demonstrate that visually similar construction materials can be successfully differentiated using hyperspectral data, confirming the feasibility of spectral-based material identification. The findings also show that environmental constraints, particularly lighting conditions, have a measurable impact on detection accuracy. In addition, the results highlight the critical role of data preprocessing strategies and classification algorithm selection in achieving reliable material identification. Building upon the pilot study findings, the third phase of the research focuses on system development and robotic integration. A custom sensor payload is designed to integrate the Living Optics hyperspectral camera with a mobile robotic platform, specifically the Boston Dynamics Spot robot. This phase addresses key engineering challenges related to payload weight, power consumption, mechanical stability, thermal management, and field durability. The payload design accounts for the operational constraints of mobile robots in construction environments, ensuring that the hyperspectral sensor can be deployed without compromising robot mobility or safety. A dedicated Robot Operating System (ROS) node is developed to enable synchronized data acquisition, robot navigation, and hyperspectral image capture. This software framework ensures temporal and spatial alignment between hyperspectral data and robot pose information, which is essential for accurate mapping, repeatable scanning, and integration with downstream progress tracking workflows. The robotic system enables autonomous navigation through construction environments and facilitates consistent data collection across multiple locations and time points, reducing reliance on manual setups and improving repeatability. The fourth phase of the

research involves field validation of the robotic hyperspectral imaging system in real construction environments. Field deployment is used to evaluate system performance under realistic site conditions, including variable illumination, surface contamination, dust, vibration, and spatial constraints. The robustness of the full sensing pipeline is assessed, from data acquisition and preprocessing to classification and interpretation. Performance metrics include classification accuracy, robustness to environmental variation, and computational efficiency. Comparative analysis is conducted to evaluate the strengths and limitations of different machine learning and deep learning models in field conditions. Particular emphasis is placed on identifying spectral regions within the visible and near-infrared ranges that provide the most discriminative features for construction materials, enabling future optimization of sensor configurations and data processing pipelines. The expected outcomes of this research include both methodological and practical contributions. From a technical perspective, the study is expected to demonstrate that hyperspectral imaging, when integrated with mobile robotics, can reliably differentiate visually similar construction materials under both controlled laboratory conditions and real-world field environments. The research is anticipated to identify effective preprocessing strategies and classification models that balance accuracy, robustness, and computational feasibility for near real-time deployment. Robotic integration is expected to enable scalable and repeatable data acquisition across large construction areas, overcoming the limitations of static or labor-intensive inspection setups. The intellectual merit of this research lies in extending the application of hyperspectral imaging to the built environment, a domain that has traditionally relied on visually based sensing modalities. By addressing challenges related to illumination variability, sensor payload integration, robotic mobility, and synchronized data collection, the study contributes new knowledge on adapting hyperspectral techniques to complex and unstructured construction environments. The research also advances understanding of how machine learning and deep learning methods can be effectively applied to high-dimensional spectral data in construction-specific contexts. From a practical standpoint, the proposed robotic hyperspectral imaging system has the potential to transform construction progress tracking and quality control practices. Automated, non-destructive material identification can reduce dependence on manual inspections, improve consistency, and minimize human error. Accurate differentiation of visually similar materials supports more reliable percent-complete estimation, reduces rework caused by misidentification, and improves project scheduling and cost control. In addition, the system can help reduce repetitive and labor-intensive inspection tasks, contributing to safer and more efficient construction operations. More broadly, this research aligns with the construction industry's ongoing shift toward automation, digital twins, and AI-enabled monitoring systems. The integration of hyperspectral imaging, robotics, and machine learning supports the development of intelligent, data-driven workflows that enhance productivity, safety, and sustainability. As construction projects continue to grow in scale and complexity, such automated sensing systems will play an increasingly important role in enabling informed decision-making and delivering high-quality infrastructure. In summary, this doctoral research presents a comprehensive investigation into the automated identification of visually similar construction materials using robotic hyperspectral imaging. Through a phased experimental approach that includes laboratory studies, system development, and field validation, the research bridges the gap between hyperspectral imaging theory and practical construction applications. The findings are expected to provide both foundational insights and actionable solutions for advancing automation and intelligent sensing in the built environment.

Title: From beverage choices to the operative room: adolescent milk and juice consumption and dental provider responses - a narrative literature review.

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Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Adolescent consumption of milk, juice, and sugar-sweetened beverages (SSBs) has increased, raising concerns for oral health and access to preventive care. This narrative literature review synthesized five studies identified via Auburn University Library and PubMed (Aug 2025-Jan 2026; published 2013-2025), including a scoping review (38 of 687 records), a prospective cohort study (n = 879), a cross-sectional dentist survey (n = 1,059), a randomized controlled trial (n = 105), and a qualitative auto ethnography. The scoping review supported non-cariogenic properties of unsweetened milk, while sweetened milk increased caries risk. In the cohort, 45.6% of children followed a “High early” SSB trajectory; multivariable regression showed greater caries in the “High early” (MR: 1.37; 95% CI: 1.01-1.67) and “Moderate but increasing” (MR: 1.24; 95% CI: 0.96–1.60) groups versus the “Stable low”. Dentist survey results showed 68–87% used basic communication routinely, 36–79% used enhanced techniques, 59% experienced oral health literacy miscommunication, and 11% reported related patient care errors (P < .001). The RCT found drinking water versus apple juice reduced median salivary insulin (172 vs. 364 pg/mL), increased odds of insulin <170 pg/mL (OR = 10.84; 95% CI: 3.86-30.49; p < 0.001), and increased odds of 4-7 protective saliva factors (OR = 4.98; 95% CI: 1.42-17.48; p < 0.012). Compared to no drink, water similarly increased protective factors (OR = 4.63; 95% CI: 2.90-7.34; p < 0.001). Overall, findings support water and unsweetened milk consumption, moderated juice intake, and improved provider-patient communication. These gaps in counseling and socioeconomic barriers highlight the need for policy-level interventions to reduce adolescent caries and associated advanced treatment needs.

Title: Thermal Regulation of Cell Migration: Investigating the Role of Temperature on Cellular Motility and Metabolism

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Mentor: Panagiotis Mistriotis

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Temperature is a fundamental biophysical cue with profound yet poorly understood effects on cellular dynamics, particularly during migration—a process critical to cancer metastasis, wound healing, and the immune response. While physiological and pathological conditions can generate localized tissue temperature elevations, the mechanisms by which cells sense and transduce thermal signals to regulate motility remain elusive. This work employs a multidisciplinary approach, integrating microfluidic-based models and 3D viscoelastic hydrogels, to systematically dissect the impact of elevated temperature ($>37^{\circ}\text{C}$) on cell migration and invasion. Our findings reveal that a (patho)physiologically relevant 2°C increase in extracellular temperature significantly enhances migration speed in cancer and non-cancer cells, with effects amplified under physical confinement. Thermally augmented motility arises from coordinated reprogramming of cellular metabolism. Increased ATP consumption at 39°C drives elevated glycolytic flux, thereby sustaining actomyosin contractility. Elevated temperature also alters membrane dynamics and reduces cell and nuclear volume, lowering biomechanical barriers to invasion in confined spaces. Using tunable 3D viscoelastic hydrogels, we decoupled matrix viscoelasticity and stiffness to quantify temperature-dependent migratory responses across physiologically relevant microenvironments, complemented by a custom heat-generating nanoparticle-based microfluidic device for precise study of thermal cues. This research establishes a paradigm in which elevated temperature regulates migration by synchronizing metabolic energy production and cytoskeletal remodeling. By elucidating thermo-mechano-metabolic coupling, our work provides insight into how thermal microenvironments influence disease progression and tissue repair, offering a foundation for therapeutic strategies targeting temperature-sensitive pathways in cancer and regenerative medicine. **Keywords:** Cell Migration, Temperature, Metabolism, Confinement, Viscoelastic Hydrogels, Microfluidics.

Title: Testing the Allelopathic Potential of Dogfennel (*Eupatorium capillifolium*) Extract for Pigweed (*Amaranthus* spp.) Suppression

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Mentor: Aniruddha Maity

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Pigweeds (*Amaranthus* spp.) are among the most aggressive weeds throughout the world that threaten crop yields to a huge extent. Today, these weeds have developed resistance to most of the commonly used herbicide chemistries. This study explores a sustainable approach to suppress pigweed germination using a plant-based formulation. There has been evidence supporting the insecticidal and antifungal properties of dogfennel (*Eupatorium capillifolium*), a native weed in the United States. In this study, we have tested different concentrations of dogfennel extract for its allelopathic effect on pigweed seed germination under controlled conditions. Allelopathy is defined as a mechanism of plant protection where one plant species secretes specific chemicals having certain inhibiting effect on neighboring plant species. A total of 13 weeds were tested including 9 were broadleaf and 4 grasses. Major crop species were also included in the study. This was done so as to analyze the effect of allelopathic dogfennel extract on different weed species and crops. Then dose-response assay was conducted for most sensitive weed species where a range of the extract concentration was tested so as to determine the most effective dose concentration. From the results we found that extract successfully inhibits the pigweed germination when tested as a pre-emergence bioherbicide. 5% and above extract concentration successfully inhibited redroot pigweed and smooth pigweed species whereas 10% extract was required for complete germination inhibition in Palmer amaranth and waterhemp. Other weed species and crop species were unaffected by the extract showing the selective nature of the extract in killing pigweeds without harming crops. These positive results under filter paper studies shows the potential of the dogfennel extract to be used a potential bio-herbicide for pre-emergence pigweed control in crop fields. This could be a great addition to non-chemical method for control of pigweeds. This non-chemical weed control could reduce the dependence on synthetic herbicides further reducing the chances of resistance development in pigweed populations.

Title: Techno-Economic analysis of sustainable horticultural containers: Optimizing PLA-Biochar composites for cost competitiveness and carbon offsets

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Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: To mitigate the environmental impact of conventional plastic pollution, bioplastics such as polylactic acid (PLA) have emerged as promising sustainable alternatives. Biochar, a carbon-rich coproduct of biomass thermal conversion, represents a high-potential filler capable of enhancing PLA's mechanical properties while reducing overall material costs. This study evaluates the commercial viability of PLA-biochar composites to produce horticultural containers through a comprehensive Techno-Economic Analysis (TEA), supplemented by a sensitivity analysis of key process parameters. Seven container formulations were evaluated, comparing conventional polypropylene (PP) against various PLA-biochar blends. TEA results revealed that while PP remains the most economical option at \$0.13 per unit, the incorporation of biochar significantly improved the price competitiveness of PLA, reducing the unit cost from \$0.20 (neat PLA) to \$0.16 at 50 wt.% biochar loading. The analysis identified the compounding stage as a critical economic and environmental hotspot, accounting for approximately 30% of total energy consumption; optimizing this stage is therefore essential for enhancing both profitability and sustainability. Notably, biochar loadings above 20 wt.% transformed the industrial composting End-of-Life (EoL) stage into a net carbon-negative phase, thereby reducing the overall Global Warming (GW) impact. Across all scenarios, incorporating biochar into PLA consistently lowered EoL impacts due to reduced PLA consumption, lighter container weights, and soil carbon sequestration. Crucially, at higher biochar contents (40–50 wt.%), these sustainable PLA-based containers environmentally outperform conventional PP containers.

Title: Poultry litter beetle insecticide resistance in the southeastern United States

Primary Author: Reese Houck

Additional Authors: Dylan Brown;

Mentor: Nannan Liu

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The Poultry Litter Beetle (PLB) is a growing issue within the poultry industry. PLB causes significant economic loss by spreading disease, causing indigestion, and destroying poultry house infrastructure. The cheapest and easiest management strategy is to apply insecticide; however, the overapplication of insecticides has caused widespread resistance. This resistance is currently not well monitored, but doing so would provide vital information for a producer's ability to create successful integrated pest management programs. To provide this information to producers, we sampled PLB across six major poultry-producing states and performed insecticide bioassays to quantify resistance. Through Probit analysis, we found extremely high resistance to malathion and permethrin in most populations with resistance developing for imidacloprid and spinosad. Additionally, we seek to elucidate the genetic mechanisms underlying resistance by sequencing cDNA from resistant and susceptible PLB populations. We have sequenced the acetylcholinesterase gene (Malathion's target) and the voltage gated sodium channel gene (Permethrin's target) from our insecticide susceptible and resistant populations. We expect genetic mutations to confirm our bioassay results, and these newly sequenced genes may be used to develop new resistance sampling methods and treatments.

Title: Balancing Act of Mapping Famsin's Clinical Impact: Famsin's Protective and Toxic Associations in Metabolic and Neurological Conditions

Primary Author: Rex Usry

Additional Authors: Muralikrishnan Dhanasekaran;Suhrud Pathak;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Diabetes mellitus (type 2-T2DM, type 1) remains a leading cause of mortality globally, along with numerous morbidities, often necessitating lifelong management due to complex genetic and environmental factors. Recently, Famsin, a Gastrointestinal tract-derived hormone secreted during fasting, has emerged as a potential regulator of energy homeostasis. While famsin has been implicated in modulating pathways relevant to T2DM and obesity, its broader clinical associations and receptor pharmacology remain unexplored. Understanding these clinical relationships is essential for developing targeted therapies addressing glucose dysregulation. This study evaluates the protective and detrimental effects of famsin modulation across prevalent metabolic and neurological disorders. A comprehensive literature search was conducted through January 2026 across PubMed, CDC, and WHO databases. A total of 217 metabolic and 242 neurological disorders were analyzed, with famsin's reported effects categorized as beneficial, toxic, or neutral. An exploratory investigation into famsin pharmacology was performed to identify potential agonists and antagonists. Our analysis revealed that famsin was associated with significant beneficial outcomes in various metabolic and toxic effects of other disorders. Beneficial associations were predominantly observed in energy-deficient states, while toxic correlations were concentrated in disorders involving impaired glucose regulation. Notably, all neurological disorders examined demonstrated toxic associations with famsin, suggesting a consistent link between famsin-related hyperglycemia and exacerbation of neurodegeneration or ischemic injury. This assessment presents a comprehensive, systems-level map of famsin's clinical associations across 459 conditions, providing a hypothesis-generating framework for future research. Further mechanistic studies are warranted to translate these correlative findings into definitive clinical applications.

Title: The impact of camp CHEW on food, nutrition, and cooking skills and knowledge

Primary Author: Riley Griffith

Additional Authors:

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Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Early childhood is a critical period for developing lifelong health behaviors, including nutrition-related knowledge and decision-making skills. This research project examines the impact of teaching basic cooking skills to elementary-aged children on their confidence in nutritional skills and food-related decision-making. By actively engaging children in the cooking process, the project aims to foster self-efficacy, independence, and a positive relationship with food. Data were collected through pre- and post- self-evaluation surveys in which children assessed their own confidence in tasks such as understanding basic nutrition concepts, assessing cooking skills, and analyzing food and nutrition skills. Findings indicate that experiential learning through cooking is associated with increased self-reported confidence in nutritional skills and greater interest in healthy eating behaviors. These results suggest that incorporating cooking education into elementary settings may be an effective strategy for supporting nutrition education and building confidence at an early age.

Title: Triggered to click: Emotional arousal and algorithm-driven purchasing in Auburn students

Primary Author: Rin Jeon

Additional Authors: Sumin Kang;Sunghyun Kim;

Mentor: Myounggi Chon

Department/Program: COSAM Administration

College: College of Sciences and Mathematics

Abstract: Online shopping has become more accessible, making purchasing faster and more emotionally driven, particularly among college students. Algorithm-driven recommendation systems personalize content based on users' browsing and purchase histories, which reduces careful decision making and encourages impulsive buying. When users experience emotional states such as stress, excitement, or boredom, they are more likely to engage with these recommendations, leading to unplanned purchases. Although these purchases may provide short-term emotional relief, they often result in post-purchase regret and a reduced sense of control over spending. This study examines how emotional arousal influences algorithm-driven purchasing behavior among Auburn University students. Specifically, it explores how different emotional states shape engagement with algorithmic recommendations, impulsive buying tendencies, and regret after purchasing. By emphasizing emotional arousal as a key psychological factor, this research seeks to better understand how online shopping platforms interact with users' states to intensify impulsive consumption. This study aims three research questions: (1) Does emotional arousal increase engagement with algorithmic recommendations? (2) Which emotional states are most strongly associated with impulsive purchases? (3) Is emotional arousal related to post-purchase regret? Data will be collected through a quantitative survey administered to Auburn University students. The survey will use a 5-point Likert scale to measure emotional arousal, engagement with algorithmic recommendations, impulsive buying behavior, and post-purchase regret. Participants will report their emotional experiences during online shopping and their reactions to personalized recommendations. This approach aims to clarify the relationship between emotional triggers, algorithmic influence, and purchasing outcomes, contributing insight into emotionally driven consumer behavior among college students.

Title: Physics-Informed and AI-Based Estimation of Spectrally Averaged Sky Radiance and Photon-Flux-to-Irradiance Ratio from Simulated Low-Spectral-Resolution Cameras

Primary Author: Robert Spicer

Additional Authors: Colby Tillman;

Mentor:

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Hyperspectral cameras can be calibrated to measure diffuse sky radiance in high spectral resolution, but the images they produce require significant time and memory. For some applications, a detailed spectrum of radiance is unnecessary. In this work, we use hyperspectral sky images to simulate four-channel and three-channel images considering both spectral response and vignetting by the optical train. These images are then used with machine learning models to predict the spectrally averaged radiance and photon flux. We compared three channel-construction approaches: a four-channel radiance representation incorporating a spectral response similar to that of a multispectral camera and lens absorption effects similar to the lens of a drone camera, a three-channel radiance representation modeled using a spectral response similar to a typical phone camera and the same lens absorption effects, and a constrained learned spectral aggregation approach in which a neural network estimates parameters of fixed spectral weighting functions. Importantly, the learned aggregation is physically constrained and does not allow unconstrained latent feature learning. Results show that radiance reconstruction is dominated by linear spectral mixing, with simple linear models achieving near-perfect correlation when sufficient spectral coverage is retained. In contrast, prediction of the photon-flux ratio exhibits strong nonlinear dependencies across channels, with gradient-boosted models providing substantial error reductions relative to linear baselines. Near-infrared information consistently improves performance across all channel-construction strategies, and the constrained learned aggregation demonstrates advantages over fixed parameterized channel models for photon-flux estimation.

Title: Event as a Driver of Sustainable Development of Small Towns – A Case Study of Auburn–Opelika

Primary Author: Rojan Baniya

Additional Authors: Oye Odei;

Mentor: Baker Ayoun

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: Small towns often have limited resources, but community events can help them grow in smart and sustainable ways. This study looks at how regular events in Auburn–Opelika support the local economy, protect the environment, and strengthen community life over the long term. We will use a mix of interviews and surveys: talking with city officials, local business owners, and event organisers, and asking residents how attached they feel to their town and how proud they are of it. The study will examine how events bring in visitors and money, support small businesses, encourage the protection of local culture and history, and test eco-friendly ideas such as better waste management or clean energy showcases. Our goal is to see whether these “temporary” events can lead to lasting policies and habits that make the town more resilient and sustainable. The results will help show how festivals and community gatherings can be used as practical tools for long-term development, not just short-term entertainment.

Title: Impact of dietary organic acids and their derivatives on gut microbiome of Salmonella-challenged broilers

Primary Author: Ruby Paudel

Additional Authors: Sabin Poudel;Dianna Bourassa;Jinquan Wang;Shijina Raj Manjankattil Rajan;Farazi Abinash Rahman;

Mentor: Sabin Poudel

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The study aimed to evaluate effects of dietary organic acids derivatives on the microbiome of duodenum, jejunum and ileum of Salmonella challenged broilers. 800 Ross 708 male broilers were randomly divided into four treatments with 8 replicates and 25 chicks/replicate. Birds were inoculated with a nalidixic acid resistant Salmonella Typhimurium strain at 10⁵ CfU/bird on d7. Four dietary treatments include T1) Control; T2) formic acid-based blend at 3 kg/mt; T3) short-/medium-chain monoglycerides blend at 1.5 kg/mt; T4) combination of T2 and 3. The fecal content from middle portion of intestinal segments was collected on d14 and d35. Genomic DNA was extracted and full-length 16S rRNA sequencing was done using MinION. MinKNOW and EPI2ME were used for base calling, demultiplexing, and taxonomic classification. Data was analyzed in R using Phyloseq package. Alpha diversity metrics (Shannon, Simpson and Chao1) were non-significant for duodenum, jejunum, and ileum at d14 and d35. However, Pielou evenness was significant in duodenum on d35 ($p = 0.047$). In addition, no significant difference was found between the treatments in beta diversity (Jaccard and Bray-Curtis, $\text{adonis } p > 0.05$) on d14 and d35 in the intestinal segments. *Comamonas testosteroni* was the only bacterium found to be differentially abundant in duodenum on d14, specifically in treatments T2 and T3. *Lactobacillus crispatus*, *Ligilactobacillus salivarius*, and *Limosilactobacillus reuteri* were the predominant taxa across all the intestinal segments in d14. A distinct community shift was observed by d35 with increase in abundance of *L. crispatus* and decrease of *L. salivarius*. Overall, these results indicate that dietary supplementation of organic acids had minimal impact in the duodenum at early age under Salmonella challenged condition.

Title: Cold plasma-induced molecular modifications of guar gum enhances its engineering properties

Primary Author: Rudro Deb Sardar

Additional Authors: Amit Morey;Sofia Sierra Melendrez;

Mentor: Amit Morey

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Cold plasma, the 4th state of matter, through its highly reactive ionic particles, offers a unique opportunity to modify the molecular structure of food ingredients, altering their functional properties. Guar gum (GG), a widely used natural, non-ionic polysaccharide with high thickening and stabilizing ability, was treated with helium cold plasma for different exposure durations (0 (Control), 10 (P10), 15 (P15), and 20 (P20) min), and were studied for rheological behavior (0.1%, 0.5%, and 1% w/v water), electrochemical, and physical properties to compare with untreated GG. At 0.5%, untreated GG showed higher apparent viscosity and yield stress (1870 cP), while plasma treatment negatively affected these parameters. In contrast, at 1.0% concentration, plasma-treated GG revealed higher viscosity than the control, particularly at low shear rates (P20: 15439 cP > P15: 12196 cP > P10: 11059 cP). Dynamic frequency sweep analysis demonstrated that in high concentration (1%), storage modulus (G') decreased while loss modulus (G'') increased with increasing frequency for all samples. P20 indicated less G' (20 pa) and G'' (15 pa) at 25 rad/s. Tan δ analysis revealed a frequency-dependent viscoelastic transition in all samples. At low frequency (up to 40 rad/s), all samples showed elastic solid behavior, and after that it behaved like a viscous liquid at high frequency. However, P20 contributed an earlier crossover and a lower peak tan δ (2.38 at 63 rad/s) compared to the control (3.40 at 68 rad/s). Plasma treatment did not significantly affect pH (6.2-6.8), while electrical conductivity (EC) decreased. Bulk and tapped densities remained unchanged across samples, whereas true density rose progressively with plasma exposure, from 1.45 g cm⁻³ (control) to 1.88 g cm⁻³ (P20). Overall, helium cold plasma affects the rheological and physicochemical properties of GG, suggesting a potential approach to modify the functional properties of hydrocolloid.

Title: Lead ion removal from aqueous solutions using biochar materials from different wood species

Primary Author: Ruiqi Li

Additional Authors: Thomas Elder;Yucheng Peng;

Mentor: Yucheng Peng

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The increasing severity of heavy metal contamination in water resources is driven by industrialization and urbanization. It is necessary to develop efficient remediation methods to reduce heavy metal bioavailability and mobility. Biochar has emerged as a promising adsorbent due to its unique physicochemical properties, including high surface area, abundant surface functional groups, and inorganic mineral content. However, the performance of biochar in heavy metal adsorption varies significantly depending on the feedstock. This study investigated the influence of feedstock on lead ion adsorption by characterizing the physicochemical properties and lead ion adsorption capacities of twelve woody biochar materials. Results revealed that lead ion adsorption capacity was primarily governed by biochar pH, EC, and mineral content (e.g., calcium carbonate). In contrast, parameters such as specific surface area, elemental composition, and porosity exhibited limited correlation with adsorption efficiency. These findings highlight the critical role of feedstock selection in customizing biochar to enhance heavy metal remediation. This study provides actionable insights for designing cost-effective, feedstock-specific biochar to address lead contamination in aquatic environments.

Title: Mind the Gaps: Robustness of DNN Ankle Joint Angle Prediction Models to Unexpected Sensor Flatlines

Primary Author: Ryan Pollard

Additional Authors: Michael Zabala;Roberto Molinari;Ivan Nail Ulloa;Matheus Ferreira-Shornack;Jaxie Brokamp;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Despite promising results for deep neural network (DNN)-based lower-limb kinematic prediction, these models' robustness to sensor loss during deployment is unclear. Thus, the purpose of this study was to investigate the effect of erroneous, flatlined sensor data on DNN model performance as a function of sensor count, type, and placement, and to subsequently propose a simple, sensor-agnostic training modification to mitigate this negative effect of missing sensor input data on future joint angle prediction. Lower-limb kinematic and myoelectric data from 21 participants were extracted during five unique actions (walking, ramp ascent/descent, and stair ascent/descent). Tuned, two-layer Long Short-Term Memory (LSTM) models were trained to predict sagittal-plane ankle angles at a 200 ms prediction horizon from various combinations of wearable sensor combinations. The LSTM models were trained while intermittently simulating that up to 3 random sensors were flatlined for each input window (i.e., sensor data replaced with a single random value within the sensor's recorded range). Each model was then tested on a held-out dataset with up to 3 simulated flatlined sensors and model performance was evaluated. Model performance during test was found to significantly degrade as the simulated dropped sensor count increased, but this performance decrement was mitigated in models that were trained on larger counts of simulated dropped sensors. The results of this study indicate that, during model testing, flatlined sensor data is significantly decremental to model performance, posing a significant limitation to LSTM-based model implementation in the real world. However, intermittently flatlining sensor data during LSTM model training was shown to significantly improve model performance during flatlined sensor test. Thus, joint angle prediction LSTM models may benefit from intermittently flatlining sensor data during training to ensure robustness to sensor failure during deployment.

Title: Examining the contribution of trunk lean at ball release to shoulder distraction force during in-game pitching in collegiate baseball pitchers

Primary Author: Ryan Teague

Additional Authors: Gretchen Oliver; Kevin Rodriguez Chavarria; Ryan Zappa; Kai-Jen Cheng;

Mentor: Gretchen Oliver

Department/Program: School of Kinesiology

College: College of Education

Abstract: Baseball pitching relies on coordinated whole-body movement, with trunk positioning playing a key role in upper-extremity loading. As such, trunk mechanics may be a modifiable factor for reducing the risk of shoulder injury in collegiate pitchers. This study aims to examine the relationship between maximum shoulder distraction force and trunk lateral tilt in collegiate baseball pitchers during in-game conditions. Data from NCAA Division I baseball games held at Auburn University were incorporated into this investigation. Only fastball pitches delivered during official competitive games were analyzed. 200 NCAA DI baseball pitchers (Mass: 91.12 ± 10.14 kg; Height: 1.88 ± 0.06 m; Ball velocity: 91.99 ± 2.56 mph). were included. Pitching kinematics were captured with a KinaTrax markerless motion-capture system (300 Hz). A backward linear regression model was used to examine the relationship between maximum shoulder distraction force and trunk lateral tilt at foot contact, maximum shoulder external rotation, and ball release. Trunk lateral tilt at ball release accounted for 5% of the variance in maximum shoulder distraction force, representing a small effect; however, the regression model predicting shoulder distraction force from trunk lateral tilt was statistically significant ($F(1, 198) = 10.814$, $p < .001$). Trunk lateral tilt at ball release was the only significant predictor ($\beta = 4.641$, $t(198) = 3.289$, $p < .001$), indicating that with greater trunk lean towards the throwing arm higher shoulder distraction force was observed. These findings suggest that excessive arm-side lateral trunk lean at ball release increases shoulder loading during pitching, highlighting trunk position as a potential feature for injury risk reduction in collegiate baseball pitchers. Optimizing trunk positioning at ball release may therefore help reduce shoulder injury risk in collegiate baseball pitchers.

Title: Clethodim Application's Effectiveness for Controlling Annual Ryegrass (*Lolium multiflorum*)

Primary Author: Ryan Tyson

Additional Authors: Henry Pliske; Kevin Ostrander;

Mentor: Will Gully

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Invasive annual ryegrass (*Lolium multiflorum*) can reduce the productivity and effectiveness of clover (*Trifolium* spp.) food plots by competing for light, nutrients, water, and space, potentially limiting their value as wildlife forage. This study evaluated the effects of the grass-specific herbicide clethodim on *L. multiflorum* invasion in clover food plots and assessed how resulting vegetation changes influence White-tailed deer (*Odocoileus virginianus*) use. Three food plots were mowed, disked, and planted with Crimson clover (*Trifolium* spp, Dixie Reseeding, The Wax Co LLC), after which each plot was divided into two equal halves consisting of a control (unsprayed) treatment and a clethodim-treated area. Plots were allowed to establish for 48 days prior to herbicide application to ensure adequate Crimson clover growth and Annual ryegrass presence. Vegetation sampling was conducted by clipping three 1-m² quadrats per plot at ground level. Plant material was separated by species, oven-dried, and weighed to quantify species-specific biomass. Point-intercept sampling was also conducted to estimate plant cover and community composition. Camera traps were deployed to quantify White-tailed deer activity and compare relative use between control and treated plot halves. Sixty days following clethodim application, all plots will be resampled using identical methods. We expect clover biomass to be greater in clethodim-treated plots due to reduced competition from invasive annual ryegrass and predict higher deer use in treated areas resulting from increased forage availability. Understanding effective strategies to manage invasive grasses in food plots is important for improving habitat quality, maximizing forage production, and ensuring cost-effective land management for wildlife. Results from this study will provide practical guidance for land managers seeking to enhance white-tailed deer forage while minimizing negative impacts of invasive species on food plot performance.

Title: Modeling inconsistent system alternative selection: Impacts from differing affordability definitions within NASA Marshall Space Flight Center

Primary Author: Ryleigh Claire Stokley

Additional Authors:

Mentor: Casey Eaton

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: This research presents results from a survey completed by 172 employees of NASA Marshall Space Flight Center. Systems engineering often employs “-ilities,” such as affordability, to represent various aspects of a system. While professionals widely use these “-ilities,” exact definitions for the terms can vary between individuals. Researchers have not yet thoroughly studied the degree to which definitions for a concept such as affordability can differ within a single organization. We categorize definitions of affordability from each survey participant according to the participant’s usage of cost and benefit notions. While most definitions of affordability include a degree of cost notion, only a subset balance cost against a benefit. Additionally, a subset of individuals’ definitions treats affordability as a binary constraint: A system either is affordable, or it is not. Others define it in more continuous terms as though it were an objective for maximization. From these definitions, we categorized 86 of the 172 participants as involving a cost constraint with no clear benefit component. The research develops a series of mathematical equations to evaluate a set of system alternatives for the eight distinct categories of definitions observed. We show that practitioners following differing definitions of affordability will select different system alternatives. Due to the variety of definitions of affordability observed and the impact modeled, practitioners should be cautious about assuming what stakeholders and fellow decision makers mean when using the term affordability.

Title: Genome-wide transcriptomic analysis reveals WRKY75-dependent regulation of ethylene-responsive gene networks in *Arabidopsis thaliana*

Primary Author: Sabina Tiwari

Additional Authors:

Mentor: Hao Chen

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Ethylene signaling regulates key aspects of plant development, stress responses, and defense, yet how WRKY transcription factors integrate into ethylene-responsive transcriptional networks remains poorly resolved. Here, we examined how inducible activation of WRKY75 reshapes ethylene-responsive gene expression in three-day-old *Arabidopsis thaliana* seedlings using an estradiol-inducible WRKY75 system. Transcriptomic analyses under air and ethylene conditions revealed that both the WRKY75 genetic background and estradiol-induced activation drive extensive, context-dependent transcriptional reprogramming. Principal component analysis showed clear separation of samples by genotype, hormone treatment, and induction state, supporting a strong regulatory influence of WRKY75. Under air conditions, estradiol induction within the WRKY background resulted in 2,749 differentially expressed genes (1,316 upregulated and 1,433 downregulated), while the WRKY background alone altered expression of 2,792 genes (1,278 upregulated and 1,514 downregulated) relative to wild type, indicating a substantial basal effect of WRKY75 on the transcriptome. Only 73 genes (1.9%) were shared across all air-condition comparisons, highlighting strong context specificity. Comparisons under ethylene further revealed that WRKY75 background and inducible activation substantially reprogram ethylene-responsive transcription, with selective overlap with canonical EIN3-regulated gene sets. Clustering analyses identified multiple WRKY75-dependent transcriptional modules, including rapidly inducible genes, feedback-regulated ethylene-associated modules, and indirectly regulated stress- and signaling-related pathways. Functional annotation and enrichment analyses indicated that these modules are enriched for transcriptional regulation, hormone signaling, stress response, and cell wall-associated processes. Together, these results demonstrate that WRKY75 acts as a selective regulator that both primes and remodels ethylene-responsive gene networks, fine-tuning ethylene signaling outputs rather than simply recapitulating EIN3-mediated transcription.

Title: Remote Sensing Based Geospatial Assessment of Surface Water Expansion and Salinity Rise in the Devils Lake Basin Using Google Earth Engine

Primary Author: Sabrina Karim

Additional Authors:

Mentor: Luke Marzen

Department/Program: Geology and Geography

College: College of Sciences and Mathematics

Abstract: This study explores the detection of surface water and salinity changes in the Devils Lake Basin to analyze salinity patterns in relation to fluctuating water levels, North Dakota, from 1990 to 2023, using the Google Earth Engine (GEE) platform and Python API. The research aims to understand the relationship between surface water extent and salinity levels in response to prolonged wet conditions, climate variability, and hydrological changes. NDWI (Normalized Difference Water Index) and NDSI (Normalized Difference Salinity Index) were determined from Landsat 5 and 8 satellite imagery to analyze water and salinity dynamics within the basin. Results indicate that surface water extent has significantly increased over the study period, but lake salinity has also risen, contrary to typical dilution expectations. It identifies temporal and spatial correlations between increasing water extent and salinity levels, revealing that as water levels rise, salinity initially decreases due to dilution effects. However, continued expansion combined with evaporation leads to salinity accumulation, particularly in closed-basin areas. In addition with that ,this trend might be influenced by runoff from surrounding high-elevation areas, transferring salts into the expanding lake, which concentrates salinity within the lake water. Meanwhile, salinity in the surrounding land areas decreased. These findings highlight the complex interplay of lake expansion, elevation gradients, evaporation rates, and climate factors, emphasizing the need for further exploration of this dynamic situation to develop strategies that preserve the surrounding ecosystem in Devils Lake.

Title: Genetic variation causes structural variation in the IGF1 protein among Anolis lizards

Primary Author: Sagar Bhowmik

Additional Authors: Tonia Schwartz; Abby Beatty; Megan Benedict; Morgan Muell; Blake Lee;

Mentor: Tonia Schwartz

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Anolis lizards have diversified in morphology including body size, limb lengths, and coloration. The insulin and insulin-like signaling pathway plays crucial roles in determining many aspects of body size and shape. This study investigates the genetic variation and protein structural variation in the insulin-like growth factor 1 (IGF1), a key hormone in this pathway, across nine Anolis species. IGF1 sequences were obtained from public databases or newly generated for a subset of species. Every species had a unique IGF1 amino acid sequence, with substantial amino acid variation (42.7% identity) concentrated in the functionally important C-domain of the IGF1 protein that regulates binding affinity between the IGF1 and its receptors. To test if the sequence variation affects protein structure, we used different protein modelers (Swiss-Model, AlphaFold, Modeller) to predict high-quality structures. Using the green anole, *A. carolinensis*, as a reference, we conducted structural comparisons using PyMOL that revealed varying levels of conservation across the species. Further analyses are being conducted contrasting each species' structure to predict whether the changes are likely to alter the hormone-receptor binding affinity, providing broader insights into the evolutionary mechanisms driving the remarkable morphological diversity within this genus.

Title: Integration of experimental data with hybrid modelling to enhance hydrogen production in fluidized bed gasification

Primary Author: Sagar Kafle

Additional Authors: Surendar Moogi;

Mentor: Sushil Adhikari

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Hydrogen is regarded as the fuel of the future, and its production from low-grade waste via gasification appears to be a promising, economically feasible option. As gasifier performance is influenced by several factors, including feedstock characteristics and process parameters, understanding these influences is essential for optimizing performance. Thus, the study experimentally explored how various oxidizing agents, including equivalence ratio (ER), steam-to-carbon ratio (S/C), and CO₂-to-carbon ratio (CO₂/C), affect syngas composition and the formation of tar and contaminants. The study used the Box-Behnken method to design experiments and conducted 14 lab-scale experiments using pine wood residue as the feedstock. Further, the study employed a hybrid model approach combining experimental data with the equilibrium model (Aspen Plus®) and machine learning (ML). ML is trained based on the Aspen Plus® prediction error. Finally, the response surface methodology (RSM) was employed to identify the best parameters for enhancing hydrogen and lowering tar yield. The study found that gasifying agents significantly influence gasifier performance, and optimal conditions were identified as an equivalence ratio (ER) of 0.1, steam-to-carbon ratio (S/C) of 4, and CO₂-to-carbon ratio (CO₂/C) of 0.69, yielding a predicted lower heating value (LHV) of 7.9 MJ/Nm³, carbon conversion efficiency (CCE) of 84.9%, cold gas efficiency (CGE) of 96.9%, tar production of 3.7 g/kg of pine residue, with H₂ at 41.2% and CO at 36.0%. The study's findings could help set the process parameters to optimize hydrogen composition in syngas at the industrial level and help reduce the number of experiments in future studies.

Title: Asthma Camp Participation and Its Impact on Pediatric Asthma Control: A Six-Year Longitudinal Study

Primary Author: Sajel Amin

Additional Authors: Amy Pridemore; Linda Gibson-Young;

Mentor: Linda Gibson-Young

Department/Program: Nursing

College: College of Nursing

Abstract: Asthma is the most common chronic childhood illness in the United States, affecting approximately 5 million children. Alabama ranks 45th nationally in child asthma outcomes, with many children experiencing poorly controlled symptoms, school absences, emergency department visits, and hospitalizations. Long-term evidence on sustained asthma intervention effects remains limited, particularly in rural and underserved populations. A retrospective longitudinal cohort study analyzed clinical and self-reported data from children across multiple East Alabama counties, ages 7 to 12 years, who attended a free, three-day asthma education camp between 2018 and 2025. Data included demographics, asthma severity, medication regimens, asthma action plan status, peak expiratory flow readings, geographic location, and Asthma Control Test (ACT) scores reported by children and parents. The total sample included N = 85 participants, with 74% retention (aged out after 12 years old) among repeat attendees and 60% attending more than one year. Within-subject analyses examined pre–post ACT changes for each camp year, and longitudinal mixed-effects models assessed trends across repeated attendance ($\alpha = 0.05$). Mean ACT scores improved from pre-camp to post-camp by an average of 1–3 points, with shifts from poorly controlled to well-controlled categories and the greatest gains among repeat participants and children from rural counties with higher baseline symptom burden. The proportion of children with documented asthma action plans increased from 5% to 100% over the study period. Peak expiratory flow readings demonstrated greater within-session stability by day three of camp compared to day one. No external control group was included; findings reflect within-subject changes over time. Participation in this community-based pediatric asthma camp was associated with meaningful improvements in asthma control and supports asthma camps as a scalable strategy in rural and underserved communities.

Title: Evaluation and identification of southern highbush blueberry cultivars for frost- tolerance in Alabama

Primary Author: Sakshi Pathania

Additional Authors:

Mentor: Sushan Ru

Department/Program: Horticulture

College: College of Agriculture

Abstract: Blueberry is the second-largest fruit crop in Alabama; however, the state's blueberry acreage remains limited compared with neighboring states such as Georgia, Florida, and North Carolina, partly due to the lack of locally adapted and competitive cultivars. Southern highbush blueberries (SHB) are favored for their large berry size and superior fruit quality; however, their susceptibility to spring frost poses a significant challenge to cultivation in Alabama. The objective of this study was to identify frost-tolerant SHB cultivars suitable for Alabama through a multi-location trial conducted from 2023 to 2025 at two sites: Central Alabama at the E.V. Smith Research Station, Tallahassee, AL (EV), and South Alabama at the Brewton Agricultural Research Station, Brewton, AL (BW). A total of 27 advanced selections and 15 cultivars were evaluated for yield (g), average berry weight (g), total soluble solids (°Brix), titratable acidity (%), firmness (g/mm), and bloom percentage. In 2023, late-blooming selections such as NC5289 and NC53104 recorded the highest yields despite a severe spring frost. In contrast, the absence of severe late spring frost in 2024 resulted in high yields across most genotypes. Among two-year-old plants, San Joaquin (5035 ± 710 g) and NC5289 (3797 ± 213 g) produced the highest yields at EV, while TH-2976 (3375 ± 663 g) and NC5289 (2984 ± 440 g) led at BW. Among one-year-old plants, Gumbo (1814 ± 522 g) at EV and FL17-141 (1240 ± 230 g) at BW achieved the greatest yields. Colossus (3.2 ± 0.6 g at EV; 4.8 ± 0.3 g at BW) and Patrecia (3.0 ± 0.8 g at EV; 3.8 ± 0.1 g at BW) exhibited the largest average berry weights across both locations. Overall, late-blooming and high-yielding selections such as NC5289 and NC5314 show strong potential for Alabama production even without frost protection. In years without significant frost events, mid-season genotypes such as Gumbo also perform well and represent a viable option for Alabama growers.

Title: Performance of constructed wetlands systems for remediation of fish aquaculture wastewater

Primary Author: Sally Wingard

Additional Authors: David Blersch;

Mentor: David Blersch

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Wastewater generated by aquaculture systems contains elevated concentrations of nutrients such as nitrogen and phosphorus, which can negatively impact receiving water bodies by promoting eutrophication, algal blooms, and hypoxic conditions. Treating aquaculture wastewater prior to discharge is therefore critical for reducing downstream ecological degradation. Constructed wetlands provide a passive and sustainable treatment approach while offering additional ecological benefits. Although previous research has demonstrated the effectiveness of wetlands for aquaculture wastewater treatment and highlighted the role of microbial processes in nutrient transformation, the specific contribution of emergent vegetation, particularly cattails (*Typha* spp.), remains poorly quantified, and seasonal variability in plant-driven nutrient removal is not well understood. This study investigates the influence of cattails on nutrient reduction in aquaculture wastewater using six constructed wetland mesocosm systems, including three planted with cattails and three unplanted controls. Simulated aquaculture wastewater was continuously supplied, and water samples were collected from influent and effluent locations across summer, autumn, and winter seasons. Weekly samples were analyzed for nitrate, nitrite, phosphate, ammonia, and chemical oxygen demand (COD). Preliminary fall-season results indicate substantial nitrate (NO_3^-) reduction, approaching 99% across all systems, with cattail-planted mesocosms exhibiting marginally greater removal than unplanted controls. Continued multi-season data collection will capture variability associated with plant growth, microbial activity, and temperature-dependent processes, informing seasonal removal rates and design considerations. Overall, these findings will support the optimization of constructed wetland treatment systems for aquaculture applications in temperate climates.

Title: Firefighters' Underwear: Comfort and Preferences

Primary Author: Salman Chowdhury

Additional Authors: Dawn Michaelson;

Mentor: Dawn Michaelson

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Firefighters are always at risk of simple 1st degree to life-threatening 4th degree burns. Although they always wear specialized suits (turnout gears) during operation, in a flash fire, these gears form char and break apart, exposing their bare skin to flames, if they do not wear any flame-retardant or resistant undergarments. Although such garments exist in the market, wearing flame-retardant or resistant (FR) undergarments is neither required by standards nor common practice for all firefighters. To understand why firefighters do not use FR undergarments, some drivers (relative price perception, relative protection perception, relative moisture transferability perception, and relative comfort perception) have been selected using Branson and Sweeney's clothing comfort model. For that, a quantitative survey was conducted on the U.S. firefighters. The findings advance academic knowledge about consumer decision-making in high-risk, professional contexts, which can guide manufacturers and policy makers in designing and promoting protective clothing that aligns with firefighters' needs.

Title: An Integrated Systems Approach to Improving Soil Health and Mitigating Greenhouse Gas Emissions in Southeastern U.S. Cotton Systems

Primary Author: Saloni Jaswal

Additional Authors: Soura Gupta;Rishi Prasad;Debolina Chakraborty;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Soil health is a critical foundation of sustainable agriculture. However, it has been increasingly degraded in the southeastern US due to intensive cropping, monoculture practices, and the excessive use of synthetic fertilizers. Poor soil health has resulted in elevated bulk density (high compaction), reduced microbial activity, rapid depletion of soil organic carbon, and increased vulnerability to nitrogen (N) losses, contributing to greenhouse gas (GHG) emissions. Plant-growth promoting rhizobacteria (PGPR) are root-colonizing bacteria that stimulate plant growth by direct and indirect mechanisms. Biochar is a carbon-rich material produced by pyrolysis of biomass that can help improve carbon sequestration, organic matter, and water retention. This study evaluated the integrated effects of PGPR, biochar, and variable nitrogen rates on soil health indicators, GHG emissions, and crop performance in cotton (*Gossypium hirsutum* L.) production system. A field experiment was conducted during the 2025 growing season at the Wiregrass Research and Extension Center (WREC), Headland, Alabama. Soil physical, chemical, and biological indicators of soil health were assessed before cotton planting and after cotton harvest. Gas samples were collected bi-weekly, and in situ fluxes of CO₂, N₂O, and CH₄ were measured using non-steady-state, static chambers and analyzed in the laboratory within 24 to 48 hours. Results indicate the range of emissions for N₂O from 284 to 1400 g ha⁻¹day⁻¹, and CO₂ emissions ranged from 2.67×10^6 to 8.55×10^6 g ha⁻¹ day⁻¹ across various N rate treatments. Integrated treatments achieved notable reductions in cumulative N₂O emissions of up to ~61% compared to conventional N management, while also moderating CO₂ fluxes. Post-harvest measurements showed substantial improvements in soil health indicators, with active carbon and microbial biomass carbon increasing by 120% and 136%, respectively, compared to pre-planting levels. These results highlight the effectiveness of the integrated approach in enhancing microbial activity and overall soil health. However, long-term monitoring is necessary to confirm the persistence of these improvements.

Title: Headspace analysis of viral cell culture and odor transfer to polymer-based canine training aids for biological detection

Primary Author: Samantha Hagerty

Additional Authors: Melissa Singletary;Michelle Aono;

Mentor: Melissa Singletary

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: The advanced canine olfactory system is well-known for odor detection capabilities across disciplines, with recently demonstrated potential in surveillance of infectious agents and disease. However, challenges associated with biodetection include limited access to restricted source material and odor complexity. Previous canine trials introduced polymer-based odor capture and release (POCR™) training aids (TA) to present cultured viral target odor without genetic contamination. Here, we characterize the profiles of sample- and POCR™-based headspace from cells infected with three viruses: Channel Catfish Virus (CCV), Bovine Viral Diarrhea Virus (BVDV), and Bovine Herpes Virus (BoHV). Two cell lines (Channel Catfish Oocytes-CCO and Madin-Darby Bovine Kidney-MDBK) were inoculated with CCV, BVDV, or BoHV in respective lineages. Virus-infected and healthy cell lysate was collected along with cell-free media for headspace analysis using Proton Transfer Reaction-Mass Spectrometry (PTR-MS). TA were also charged with culture odor via 24-hour controlled exposure and comparatively analyzed before and after autoclave sterilization. Representative peaks were identified for viruses through partial least squares (PLS) analysis and supported by Principal Component Analysis (PCA) distributions. Partially overlapping clusters indicated several shared features between viruses. Unique peaks in live samples were also observed in headspace of charged TA counterparts, demonstrating effective absorption. Average signal intensity for selected peaks between live and TA samples varied, with some significantly increasing concentration in polymer headspace. After autoclaving required for field use of virus-charged aids, there was a significant increase in polymer-associated background volatiles, though target signals were present at reduced intensity. This work characterizes the odor profile of cultured viruses and demonstrates transfer to POCR™ training aids withstanding sterilization.

Title: Multi-scale imaging and analysis of carbonate rocks to evaluate CO₂ storage potential in the Cassville Reservoir

Primary Author: Samantha Mariano

Additional Authors:

Mentor: Lauren Beckingham

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Geologic carbon sequestration is a developing method that works to reduce atmospheric carbon dioxide emissions by capturing carbon dioxide (CO₂) and securely storing it long-term in deep subsurface rock formations. The goal is to sequester CO₂ in aqueous or solid forms, so it cannot re-enter the atmosphere. A carbonate dolomite sample sourced from the Consauga Group in a Cassville, GA reservoir is analyzed for this study. This research focuses on the processing and analysis of images collected from a carbonate dolomite sample, utilizing Scanning Electron Microscopy (SEM) Backscattered Electron (BSE) and Energy Dispersive X-ray Spectroscopy (EDS) images. Collected SEM images of the carbonate thin section are processed to create a detailed mineral map depicting each mineral as different segments and colors. The map is quantitatively processed to determine the porosity and mineral composition of the sample to understand the formation's suitability for carbon sequestration. MATLAB algorithms are employed to process the SEM and EDS data, enabling the visualization and identification of mineral phases that are present in the sample. Integrating data from SEM imaging provides a robust characterization of the reservoir's microstructure and its implications for caprock integrity and geochemical reactivity under CO₂-rich conditions. This research contributes to the broader understanding of carbonate reservoirs as viable candidates for carbon sequestration, particularly in the southeastern United States. By combining experimental data with rock analysis processed digitally, the study advances the integration of multi-physics characterization techniques to support site selection, modelling, and risk assessment efforts in geological carbon storage projects. This project supported by the Southeast Regional CO₂ Utilization and Storage Acceleration Partnership (SECARB-USA) project funded by the U.S. Department of Energy and cost-sharing partners under grant number FE0031830, managed by Southern States Energy Board.

Title: Stress-induced activation of latent bacteriophages in *Vibrio* spp. serves as potentially novel therapeutic targets

Primary Author: Samantha Smith

Additional Authors: Katherine Buckley; Jake Tatum;

Mentor: Katherine Buckley

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The *Vibrio* genus is comprised of a diverse array of facultatively anaerobic, Gram-negative bacteria that have complex relationships with many different marine and terrestrial species. Some *Vibrio* sp. are common pathogens of marine invertebrates, whereas other species have been characterized as important symbiotic or commensal organisms. The purple sea urchin (*Strongylocentrotus purpuratus*) provides a unique model system for understanding host-pathogen interactions of a wide variety of *Vibrio* species. The larval forms are transparent and anatomically simple, which enables real time observations of cellular immune responses. Larvae are planktotrophic, with open gut systems that allow exposure to a remarkable diversity of environmental bacteria. Thus, sea urchin genomes encode a complex repertoire of genes that encode proteins involved in innate immune systems. *Vibrio* sp. elicit several distinct disease phenotypes in sea urchin larvae and adults (e.g., *V. diazotrophicus*, *V. coralliilyticus*, and *V. shilonii*). Our analysis of *Vibrio* genome sequences indicates that many of these species harbor bacteriophage genes, suggesting the presence of inducible latent prophages. These potential phages offer an opportunity to adapt a previously uncharacterized model to develop phage as a novel treatment strategy. We hypothesize that, during infection, activation of these dormant phages contributes to pathogenicity. We tested seven *Vibrio* sp. for phage induction in response to different environmental or chemical stressors. Phage induction was performed using Mitomycin-C (a powerful antibiotic produced by *Streptomyces caespitosus* that inhibits DNA synthesis and damages DNA replication), heat shock, and nutrient deficiency. Phage activation was assessed using bacterial growth curves. Results indicate that each of these stressors is capable of inducing lytic replication. This work represents the first characterization of phage activation in many of these species and the first use of phage treatment in this model system.

Title: Disease survey of strawberry leaf spot and fruit rot caused by *Neopestalotiopsis* spp. in Alabama

Primary Author: Samarpana Rachel Mathangi

Additional Authors: Bin Wu;Mark Liles;Edward Sikora;

Mentor: Sushan Ru

Department/Program: Horticulture

College: College of Agriculture

Abstract: Strawberry production in Alabama is facing a threat from an emerging pathogen, *Neopestalotiopsis*. *Neopestalotiopsis* causes leaf and fruit rot, which leads to significant crop losses and reduces access to clean planting material. Camarosa, a commonly grown strawberry cultivar in Alabama, is susceptible to this pathogen, highlighting the need to evaluate alternate cultivars adapted to Alabama and resistant to *Neopestalotiopsis*. This study will evaluate the distribution and aggressiveness of *Neopestalotiopsis* spp. in Alabama. Pathogens recovered from statewide surveys will be isolated into pure cultures, and *Neopestalotiopsis* strains will be molecularly characterized using PCR-based DNA analysis to identify aggressive isolates. The most virulent strains will then be used to screen multiple strawberry cultivars that demonstrated promising performance for Alabama during the 2024 and 2025 growing seasons. Virulence testing and cultivar screening will be performed under controlled conditions. The results will support the identification of cultivars with improved tolerance to fruit rot and leaf spot from *Neopestalotiopsis* and contribute to the long-term sustainability and profitability of strawberry production in Alabama.

Title: Phosphoprotein Enriched in Astrocytes-15 kDa (PEA15) in Neurodevelopment: Integrating Phenotypic and Transcriptomic Analyses in Domestic Cats

Primary Author: Samira Salimiyan

Additional Authors: Emily Graff;Douglas Martin;Amanda Gross;Olivia Grigsby;Adil Bashir;Amy Yanke;Emily Brinker;Rie Watanabe;Taylor Towns;

Mentor: Emily Graff

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Normal gyrencephalic neurodevelopment is poorly understood, and disruption in gyrification contributes to neurodevelopmental disease. Phosphoprotein enriched in astrocytes-15 kDa (PEA15) is an intracytosolic adaptor protein that regulates apoptosis, proliferation, and glucose metabolism and is highly expressed in the brain. Our lab identified a loss-of-function mutation in PEA15 in domestic cats that causes microcephaly and polymicrogyria, providing a unique gyrencephalic model for studying cortical development. This study characterized the clinical phenotype and molecular changes from developing (<4 months) and adult (>1 year) affected and normal cats. MRI revealed reduced gyral formation and significant white matter loss in affected animals. Phenotypically, affected kittens showed minimal early developmental delays but, by 4-6 months, developed progressive motor deficits, including shortened stride length, a hypermetric, ataxic gait, and delayed postural reactions. Adult affected cats lacked a menace response with decreased vision, suggesting progressive sensory deficits. Transcriptomic analysis of bulk RNA sequencing in the cerebral cortex identified dysregulation of genes involved in axon elongation, myelination, synaptic maturation, and glucose metabolism, with age- and genotype-dependent effects. Computational deconvolution using human cortical single-cell reference datasets revealed altered cellular composition, including reduced layer 4 intratelencephalic (L4 IT) neurons, near-complete loss of layer 6 corticothalamic (L6 CT) neurons in adults, and increased SST+ inhibitory interneurons. The excitatory-to-inhibitory neuron ratio (E/I) was decreased in affected cats throughout neurodevelopment. These findings support a critical role for PEA15 in maintaining cortical cellular composition and E/I balance during brain development.

Title: Effect of short-term storage on hatch success and gene expression profiles in blue catfish, *Ictalurus furcatus*, milt

Primary Author: Samitha Liyanage

Additional Authors: Xu Wang; Ian Butts; Rex Dunham; Luke Roy; Thu Dunkleberger; Kaylan Martin; Ying Zhang;

Mentor: Xu Wang

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Catfish farming is the largest aquaculture industry in the U.S., where hybrid catfish produced by female channel catfish and male blue catfish comprise >50% of the harvest. However, asynchronous sexual maturation and the limited number of male broodfish are major limitations to hybrid production. Storing sperm at low temperatures (4 °C) is a cost-effective method to mitigate these problems. In our previous study, we showed that prolonged storage reduced sperm motility and viability. This study aimed to characterize storage-induced molecular changes, identify transcriptomic markers of sperm quality, and determine the maximum storage duration that preserves sperm quality. We conducted hybrid catfish fertilization experiments using sperm samples collected from blue catfish (n=8) at 2, 4, 24, 32, 48, and 52 hours post-storage. Hatch success ranged from 69.8% at 2 hours to 0.0% at 52 hours post-storage, and hatch rates remained above 50% within the first 24 hours. RNA sequencing was performed to assess sperm gene expression profiles, with differential gene expression analyses conducted at 2-, 24-, and 48-hours post-storage. Transcriptomic analysis identified 148 differentially expressed genes (DEGs) across all comparisons (FDR < 0.05). Compared to 2 hours baseline, less than 30 DEGs were identified at 24 hours, whereas the majority of DEGs were found at 48 hours (144 upregulated and 3 downregulated). Upregulated genes at 48 hours were primarily associated with glycolysis, metabolic pathways, and coagulation-related processes, which indicated increased energy demand and changes in cellular and fluid properties. Our findings provide molecular insights into the transcriptomic responses of blue catfish milt during short-term storage, with identified markers establishing a foundation for developing objective molecular indicators to predict fertilization success, thereby contributing to improved sperm storage techniques for U.S. hybrid catfish hatchery facilities.

Title: Restoring myelin integrity in frontotemporal dementia through selective LXR- β activation

Primary Author: Sampada Tamhankar

Additional Authors: Rajesh Amin; Meenakshi Singh; Ian Steinke;

Mentor: Rajesh Amin

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Frontotemporal dementia (FTD) is a progressive neurodegenerative disorder and a leading cause of early-onset dementia, for which no FDA-approved disease-modifying therapies exist. FTD is highly observed in military combat veterans and is associated with progression toward Alzheimer's disease-related dementia. A defining pathological feature of FTD is progressive white matter degeneration driven by the loss of myelin sheaths and mature oligodendrocytes, leading to subsequent neuronal dysfunction and degeneration. The Amin Lab has developed a novel therapeutic candidate, AU403, a liver X receptor- β (LXR- β)-selective agonist designed to restore cholesterol balance and promote the maturation of oligodendrocyte precursor cells into myelin-producing oligodendrocytes. This study investigates the therapeutic potential of selectively targeting LXR- β to enhance myelin repair in FTD. Myelination deficits were evaluated using both MO3.13 oligodendrocyte cell lines and 5XFAD transgenic mouse models. AU403 treatment significantly increased the expression of key myelination-associated genes and proteins in MO3.13 cells, surpassing the effects observed with the non-selective LXR agonist GW3965. In 5XFAD transgenic mice, AU403 treatment reversed myelin deficits and restored neuronal integrity, as demonstrated by histological staining, immunoblotting-based validation of increased myelin-related protein expression, and quantitative densitometric analysis of dendritic spine density. Collectively, these findings identify AU403 as a promising therapeutic candidate for mitigating myelination deficits and neurodegeneration associated with FTD. Ongoing and future studies will focus on elucidating the molecular mechanisms by which selective LXR- β activation counteracts FTD-related pathologies and promotes white matter repair.

Title: A High-Throughput Assay for Host- and Microbiota-Derived Antimicrobial Activity on Arthropod Cuticles

Primary Author: Samuel Cavanagh

Additional Authors: Clint Penick;

Mentor: Clint Penick

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The decline in novel antibiotic discovery in recent decades has intensified the search for antimicrobial compounds in underexplored ecological niches. Arthropod cuticles harbor diverse microbial communities, which may include organisms which have evolved to produce antimicrobials as defense against competitors and entomopathogens, yet systematic screening of these communities has been limited. Social insects like ants experience particularly high pathogen pressure due to dense colonies and microbe-rich habitats, suggesting strong selection for cuticular antimicrobial defenses. Here we present a high-throughput assay for screening antimicrobial activity in arthropod cuticle extracts using widely accessible materials and standardized protocols. Our method enables rapid testing of cuticular antimicrobials, both host-derived and microbiota-produced, against clinically relevant pathogens such as *E. coli* and *Staphylococcus epidermidis*. This assay provides a scalable platform for discovering antimicrobial activity in arthropod-microbe systems and characterizing the chemical ecology of cuticular defenses.

Title: A literature review of biotic and abiotic drivers of oak wilt disease in the United States

Primary Author: Sandeep KC

Additional Authors: Hammad Ud Din;Lori Eckhardt;Zutao Yang;Rajesh Dahal;Chen Ding;

Mentor: Chen Ding

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Oak wilt, caused by the fungal pathogen *Bretziella fagacearum*, is among the most destructive diseases affecting oaks in the United States and is especially severe in red oak species, where infection causes mortality after three to six weeks of infection. This literature review synthesizes current evidence on the status of oak wilt and evaluates the interacting biotic and abiotic drivers that shape disease occurrence, spread, and severity from individual trees to landscapes. We summarize key transmission pathways, including local spread via root grafts and overland movement associated with insect vectors, and discuss how human-assisted movement of infected wood can facilitate long-distance introductions. We compare host susceptibility among major oak groups and highlight how host traits and defense capacity influence disease progression and outcomes. We also review environmental stressors that modify risk by affecting host stress, pathogen performance, and vector activity, including temperature regimes, moisture balance and drought, precipitation seasonality, and site conditions. Finally, we evaluate oak wilt detection approaches spanning symptom-based field diagnosis, laboratory confirmation, molecular assays, and emerging remote sensing methods that support earlier detection across broader spatial scales. By integrating findings across disciplines, this review clarifies the drivers of oak wilt dynamics and highlights priorities for targeted surveillance, early warning, and proactive management under ongoing environmental change in U.S. forest ecosystems.

Title: Understanding factors that influence sexual knowledge gains among adolescents

Primary Author: Sandra Anti Eyiah

Additional Authors:

Mentor: Adrienne Marks

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Adolescence is marked by heightened sexual curiosity, leading many youths to explore romantic and sexual relationships that can shape their later sexual behaviors. While these experiences can be exciting and exploratory, they also come with challenges, including the risk of unsafe sexual behaviors. Addressing these concerns requires proactive strategies such as early sexual education and strong parent-adolescent relationships, both of which are key to fostering healthy sexual development. Sexual education provides adolescents with essential information about sexual health, consent, and responsible decision-making. These lessons influence their perceptions of relationships, self-esteem, and sexual choices. Although cross-sectional studies show that early sexual education is linked to safer sex practices, fewer studies have examined its long-term impact on sexual health knowledge. Families also play a critical role in shaping adolescents' sexual knowledge and decisions. Parent-adolescent relationships encompass various dimensions, including communication, control, and parental warmth, which collectively shape adolescents' sexual knowledge and decisions. Research suggests that strong bonds promote open conversations about sensitive topics like sexuality, though findings on their direct impact on safer sex practices remain mixed. Using data from approximately 2,900 adolescents in the National Longitudinal Survey on Adolescents and Adulthood, this study employs latent change score analysis to examine whether early sexual education and parent-adolescent relationship quality predict changes in sexual health knowledge. The findings illuminate the importance of both early sexual education and strong parent-adolescent relationships in promoting adolescents' sexual health knowledge.

Title: Evaluating microplastic inputs to surface waters via runoff from Alabama agricultural fields

Primary Author: Sangam Panta

Additional Authors: Rishi Prasad;Debolina Chakraborty;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Microplastics are plastic degradation products that are less than 5 mm in diameter. It poses a severe threat to the environment and human health. It has been recognized as a global environmental concern due to its widespread contamination in agricultural soil. It can enter agricultural soil through soil amendments such as manure and fertilizers, and particularly through biosolids from wastewater treatment plants. The excessive use of manure and fertilizers to feed the growing population has led to serious environmental issues that remain largely unregulated. There is a lack of understanding regarding the fate and transport of microplastics in agricultural soils, particularly during runoff events. The overarching objective of this study is to quantify microplastic concentrations in runoff and to evaluate how different microplastic morphologies are mobilized and transported from agricultural soils. Runoff water samples were collected at different time intervals in 2022 and 2023 from a field in North Alabama. The samples were analyzed for pH and electrical conductivity (EC). The water samples were oxidized, followed by density separation. The recovered particles were analyzed using FTIR spectroscopy to understand the polymer type and MPs distribution in the runoff water samples. The results of this study will provide insight into the potential for microplastic contamination in surface waters adjacent to agricultural production areas and how this contamination varies under different management practices. Ultimately, the study will offer evidence of how microplastic transport via runoff from agricultural fields may impact the health of aquatic organisms.

Title: On-Liposome Click Reaction

Primary Author: Sanju Maharjan

Additional Authors: Wei Zhan;

Mentor: Wei Zhan

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Copper-catalyzed azide-alkyne cycloaddition (CuAAC) or “Click” reaction is fast, simple, and gives significant yield. However, Click reactions in biological systems encounter challenges such as copper toxicity, limited surface accessibility of azide and alkyne groups, stability concerns, and complex lipid environments. In this study, we aimed to develop a straightforward and readily adoptable on-liposome Click reaction procedure with optimal amounts of catalyst, reactant, ligand, and reducing agent. For the first time, this important conjugation strategy will be applied to phase-separated lipid systems such as PSM/DOPC/cholesterol. Specifically, the liposomes will be modified in such a way that it labels only the disordered liquid lipid phase with Rhodamine-DOPE. This approach will open a new pathway for modifying or incorporating different agents onto the liposome surface, enabling selective and targeted drug delivery in a simple and efficient manner.

Title: Aerobic exercise reverses hypothalamic blood-brain barrier and astrocytic alterations in renovascular hypertensive rats

Primary Author: Sany Martins Perego

Additional Authors: Vinicia Biancardi;

Mentor: Vinicia Biancardi

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Blood-brain barrier (BBB) disruption in autonomic nuclei, such as the hypothalamic paraventricular nucleus (PVN), contributes to sympathetic overactivity in hypertension. Astrocytes support BBB structure and function, but their role in renovascular hypertension (RVH)-induced BBB dysfunction is not known. We hypothesized that chronic RVH impairs PVN astrocytes, increasing BBB permeability and autonomic dysfunction, and that aerobic exercise mitigates these effects. Male Wistar rats underwent 2-kidney-1-clip surgery (RVH) or SHAM. 6 weeks later, tail-cuff recordings confirmed hypertension (RVH: 199 ± 6 vs. SHAM: 137 ± 3 mmHg). From weeks 6-10, RVH rats were sedentary (RVH-S) or trained aerobically (RVH-T: 50-60% max capacity, 1h/day, 5days/week), while SHAM rats remained sedentary. At week 10, hemodynamic and autonomic recordings were performed, BBB permeability was assessed via fluorescent tracers, and PVN astrocytes were analyzed by immunofluorescence for GFAP and Aquaporin-4 (AQP-4). RVH-S showed elevated mean arterial pressure (188 ± 5 vs. 10 ± 2 mmHg), heart rate (370 ± 9 vs. 336 ± 8 bpm), sympathetic activity (7.20 ± 0.81 vs. 4.81 ± 0.41 mmHg²) and systolic blood pressure variability (32.21 ± 2.59 vs. 17.52 ± 1.47 mmHg²), along with increased BBB permeability (5.64 ± 0.80 vs. 1.53 ± 0.13 %) and reduced GFAP (18.93 ± 0.91 vs. 31.48 ± 1.18 %) and AQP-4 (47.71 ± 3.00 vs. 100 ± 3.17 %). Exercise restored BBB integrity (1.57 ± 0.11 %), normalized astrocytic markers (GFAP: 26.87 ± 1.96 %, AQP: 91.11 ± 3.71 %), and reduced MAP (156 ± 7 mmHg), HR (318 ± 9 bpm), sympathetic activity (4.11 ± 0.55 mmHg²), and SBP variability (17.02 ± 1.85 mmHg²). In conclusion, RVH impairs PVN astrocytes, promotes BBB disruption and autonomic dysfunction, while exercise attenuates these alterations, restoring astrocytic function, barrier integrity, and autonomic control, indicating astrocytes are affected in hypertension and responsive to exercise. Funding: FAPESP (2018/14544-6; 2022/14337-6; 2024/21699-7); CNPq (304070/2019-0); CAPES (88887.388192/2019-00)

Title: Sexual dimorphism in the sucker tribe Thoburnini

Primary Author: Sara Barck

Additional Authors: Jonathan Armbruster;

Mentor: Jonathan Armbruster

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Sexual dimorphism is not always evident in fishes, but recognizing sex in the field can be important, especially when handling imperiled species. Previous literature has found few variable sexually dimorphic traits in species of the sucker (Catostomidae) genera *Hypentelium*, *Thoburnia*, and *Vexillichthys*. We measured two hundred total individuals of six species: *H. etowanum*, *H. nigricans*, *H. roanokense*, *T. hamiltoni*, *T. rhothoeca*, and *V. atripinnis*. Through statistical analysis, including one-way ANOVA and post-hoc Tukey tests, we determined the differences between the sexes at the mature and immature life stages in traits that are easily accessible in the field: pelvic-fin ray lengths, anal-fin height and length, and depressed dorsal-fin length. While none of the immature fish showed sexual dimorphism in any of the measurements, our findings suggest the difference between the seventh and third pelvic-fin rays as well as depressed dorsal-fin length may provide consistent sex determination for mature fish in *Hypentelium*, *Thoburnia*, and *Vexillichthys*. This study provides a resource for field identification of sex in these fishes, which could aid in stocking management as well as conservation surveying.

Title: Breast, cervical, prostate, and colorectal cancer screening services utilization among Medicare beneficiaries in 2019-2022

Primary Author: Sara Jaradat

Additional Authors: Jingjing Qian;

Mentor: Jingjing Qian

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Understanding the patterns and predictors of cancer screening among Medicare beneficiaries is critical for informing targeted interventions. This study examines utilisation of cancer screening services and identifies factors associated with screening among U.S. Medicare beneficiaries aged 65–75 years. A retrospective analysis of Medicare Current Beneficiary Survey (MCBS) data included community-dwelling beneficiaries aged 65–75 years who completed the survey from 2019–2022 ($n=20,535$; weighted $n=136,889,755$). Screening utilization was identified using self-reported responses among eligible beneficiaries for four cancers: breast (mammography), cervical (Pap smear), prostate (PSA test or digital rectal exam), and colorectal (colonoscopy/sigmoidoscopy, home fecal occult blood test, or ever tested). Multivariable generalized estimating equation models examined factors associated with screening, reporting adjusted odds ratios (AORs) and 95% confidence intervals (CIs). Screening uptake varied by cancer type: 52.9% reported breast cancer screening, 19.2% cervical screening, 63.5% prostate screening, and 58.3% ever completed colorectal screening. Colorectal screening increased significantly over time ($p=0.006$), whereas breast, cervical, and prostate screening showed no significant temporal change ($p=0.43$, 0.66 , and 0.34 , respectively). Race/ethnicity was a consistent predictor: Black beneficiaries had a higher likelihood of breast (AOR=1.47; 95% CI=1.24–1.76) and cervical screening (AOR=1.93; 95% CI=1.46–2.55) compared with White beneficiaries. Higher income ($>\$30,000$) was associated with greater prostate (AOR=2.47; 95% CI=1.67–3.66) and colorectal screening (AOR=1.33; 95% CI=1.09–1.62). Obesity was positively associated with prostate (AOR=1.30; 95% CI=1.10–1.55) and colorectal screening (AOR=1.16; 95% CI=1.05–1.28). Cancer screening utilization remains suboptimal and varies by cancer type among Medicare beneficiaries aged 65–75. Efforts to improve equitable access and uptake of screening among older adults are needed.

Title: The green-eyed monster: How envy and Fear of Missing Out impact social media use among college students

Primary Author: Sara Kauffung

Additional Authors:

Mentor: Sarah Lust

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: A significant amount of research has examined the effects of social media, with studies consistently finding positive associations between heavy use and increased risk for anxiety and depression, particularly among individuals who spend several hours per day on their phones. Far less is known about the underlying psychological processes—such as fear of missing out (FoMO), envy, and belonging needs—that may help explain why social media relates to poorer well-being. In Fall 2023–Spring 2024, undergraduate psychology students at Auburn University (N = 1,146) completed a Qualtrics survey assessing social media use, FoMO, benign and malicious envy, need to belong, and mental health indicators. To examine cognitive-emotional pathways linking envy to social media use and mental health, we conducted a series of mediation analyses using PROCESS Model 4. For social media engagement, both benign and malicious envy predicted greater FoMO, which in turn predicted more frequent checking and more time spent online; these indirect effects were significant, though stronger for malicious envy. To extend these pathways to mental health, four additional mediation models tested whether FoMO explains associations between envy and depressive or anxiety symptoms. FoMO significantly mediated all relationships: benign envy predicted higher FoMO, which predicted elevated depression and anxiety, with non-significant direct effects. Malicious envy also showed significant indirect effects on both outcomes via FoMO, and additionally retained a direct association with depression, suggesting partial mediation. Together, results highlight FoMO as a central mechanism linking envy to social media behavior and psychological distress, with malicious envy exerting particularly strong effects.

Title: Cultivar and Irrigation Management For Organic Systems in the Southeastern U.S.

Primary Author: Sara Paz

Additional Authors: Camila Rodrigues;Paulo Gimenez Cremonez;Andre Luiz Biscaia Ribeiro da Silva;

Mentor: Andre Luiz Biscaia Ribeiro da Silva

Department/Program: Horticulture

College: College of Agriculture

Abstract: As climate variability intensifies and the need for resource-efficient production systems increases, optimizing irrigation management in organic horticulture has become increasingly important. This study evaluated the effects of cultivar and irrigation level on yield performance of organically grown cucumber and pepper crops under drip irrigation in the southeastern United States, where coarse-textured soils present challenges for water retention and management. Field experiments were conducted on coarse soils in Alabama using four irrigation treatments corresponding to 50%, 75%, 100%, and 125% of crop evapotranspiration (ET_c). Cucumber yield was evaluated as a cultivar comparison under uniform irrigation, while peppers were assessed using a factorial design to examine cultivar × irrigation interactions. Yield data were analyzed using mixed models, and least squares means were separated using Tukey–Kramer adjustments ($\alpha = 0.05$). Cucumber cultivars differed significantly in yield, with Marketmore 76 outperforming Carosello Tondo, Armenian and Striped Armenian. In peppers, a significant cultivar × irrigation interaction was observed, with yield responses varying by cultivar across irrigation levels. Moderate irrigation reductions maintained yield for certain cultivars, whereas excessive irrigation did not confer additional yield benefits and, in some cases, reduced performance. By integrating climate-smart agriculture principles, this research highlights the potential of deficit irrigation and cultivar selection as adaptive strategies to improve water use efficiency while maintaining productivity in organic vegetable systems. The findings aim to inform regionally tailored irrigation management practices that enhance resilience to climate variability, reduce resource inputs, and support sustainable organic production on coarse-textured soils.

Title: Tracking photodoping in a P3HT film using absorbance spectrophotometry

Primary Author: Sarah Klinger

Additional Authors: Ryan Spencer;

Mentor: Christopher Grieco

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Doped organic mixed ionic electronic conductors (OMIECs) are conductive materials with potential applications in bioelectronics and energy storage. While electrochemical doping is typically used to boost polymer conductivity, recent work has demonstrated photoredox doping as a cheaper and more controlled alternative. In photoredox doping, a photocatalyst is optically excited to induce electron transfer with the polymer. However, this photodoping process remains poorly understood and methods for improving doping are lacking. The purpose of this experiment is to determine the factors that influence the photoredox doping of organic polymers such as poly(3-hexylthiophene), or P3HT. P3HT films were doped with 450 nm light using photocatalytic solutions containing the photocatalyst 9-mesityl-10-methylacridinium tetrafluoroborate (Mes-Acr-Me⁺) in the electrolyte lithium bis(trifluoromethanesulfonyl)imide (LiTFSI). The extent of doping was measured by VIS-NIR absorbance spectroscopy over time, which gives insight into the electronic nature of the polaron and the rate that the polaron is created. Using this method, we investigated the impact of the photocatalyst and counterion ratio on the extent of doping. The results suggested that photodoping is strongly dependent on both the electrolytic swelling of the polymer and the electrostatic stabilization of the polaron by an ion from the electrolyte. This study demonstrates the importance of considering steric hindrance from the polymer side chains and its impact on polymer swelling for more efficient doping.

Title: How do controlled lighting systems affect migraine management for individuals working long hours indoors?

Primary Author: Sarah Prior

Additional Authors: Lori Anderson-Guerrero;

Mentor: Lori Anderson-Guerrero

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This literature review examines the relationship between lighting conditions and migraine management in adult work environments. Research demonstrates that the type and quality of artificial lighting in workplaces are among the top contributors to migraines. Unfortunately, workplace lighting systems are often designed without considering light sensitivity, leading to persistent and unavoidable triggers for migraine sufferers. The researchers aimed to identify lighting characteristics, such as intensity, color temperature, and chromaticity, that contribute to migraine onset or relief, and to explore how controlled or adjustable lighting systems may support migraine management indoors. The guiding research question was: How do controlled lighting systems affect migraine management for individuals working long hours indoors? The methods involved a systematic search of MEDLINE, Academic Search Premier, and Health Source: Nursing/Academic Edition during the Spring 2026 semester. Predefined inclusion criteria focused on peer-reviewed studies that included adults aged 19 to 65 years, workplace settings, light exposure, and head pain. The search was guided by the keyword 'migraines' combined with each of these key phrases: circadian rhythm, workplace, and controlled lighting. The researchers documented the search utilizing a PRISMA flow diagram that specifies the screening and selection process for each database. A total of 571 articles were reviewed across all databases. If selected for presentation, findings will be illustrated through a poster presentation.

Title: Plasma concentration of acetaminophen-cysteine protein adducts after oral multidose administration of acetaminophen in adult horses

Primary Author: Sarah Walters

Additional Authors: Serena Ceriotti;Robert Arnold;Mariano Mora Pereira;Kara Lascola;

Mentor: Serena Ceriotti

Department/Program: CVM

College: College of Veterinary Medicine

Abstract: Acetaminophen-induced hepatotoxicity is associated with formation of acetaminophen-cysteine protein adducts (APAP-CYS), produced by covalent binding between N-acetyl-p-benzoquinone imine (NAPQI), the reactive phase I metabolite, and hepatocyte proteins. In humans, increased plasma APAP-CYS (> 1 nmol/mL) is a sensitive biomarker of early hepatotoxicity; however, no equine data exists. The purpose of this pilot study was to investigate plasma APAP-CYS concentrations and biomarkers of liver damage and dysfunction in two healthy adult horses receiving therapeutic acetaminophen for multiple days. Each horse received acetaminophen orally (30 mg/kg) every 12 hours for 10 days. Plasma APAP-CYS was quantified by LC-MS/MS at baseline, daily through day 10, and every 48 hours through day 14. Plasma SDH, GGT, bilirubin, and bile acids were assessed at baseline, day 7, and day 14. APAP-CYS was detected in both horses within 24 hours with maximum concentrations (3.1 and 4.1 nmol/mL) observed within 4 days of drug administration. Concentrations declined after drug discontinuation (day 10) but remained detectable on day 14. Mild GGT increases (horse 1: 30 to 43 IU/L; horse 2: 17 to 32 IU/L) and SDH decreases (horse 1: 11.5 to 5.7 IU/L; horse 2: 6.3 to 2.2 IU/L) were observed; no clinically relevant changes occurred in bilirubin or bile acids. Overall, the plasma APAP-CYS concentration exceeded the reported human hepatotoxicity threshold in both horses, without clinical or clinicopathological evidence of liver dysfunction. Larger studies are needed to define the clinical significance of APAP-CYS in horses and to determine whether observed enzyme changes are attributable to treatment or environmental factors.

Title: New roles for cytokinin response factors (CRFs) under abiotic stress and flower development

Primary Author: Satyam Singh

Additional Authors: Aaron Rashotte;Risheek Rahul Khanna;

Mentor: Aaron Rashotte

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Abiotic stress widely regulates plant growth and development. Cytokinin Response Factors (CRFs) are a subgroup of the AP2/ERF transcription factor family. CRFs are downstream components of the cytokinin signaling cascade involved in regulating plant growth and development processes under different abiotic stresses. Our study suggests new roles for both Arabidopsis CRF5 and CRF4 in lateral root growth under abiotic stresses and flower development, respectively. CRF5 is reported to be expressed throughout the vasculature of the plant, but little work has been conducted on its role in roots. Upon examination, we found increased lateral root length and number in CRF5 overexpression lines compared to wild-type (Col-0) and CRF5 mutant. A similar trend was observed when CRF5 overexpression lines were treated with drought, salt, and a combination of drought and salt stress. Drought and salt-treated CRF5-GUS lines showed a reduction in GUS expression in leaves under stresses with a shift in expression towards the lateral root tip. CRF5 overexpression lines show an increased overall electrolyte leakage under all stress conditions, but interestingly, salt stress electrolyte leakage was even higher than with the combination of drought and salt stress. CRF4 and CRF5 were also found to have a different role connected to regulating inflorescence development. CRF5 mutants and CRF4 overexpression lines show early bolting and flowering compared to Col-0, while CRF4 mutants and CRF5 OE are delayed. This suggests a new role for CRF4, which has previously been connected to cold and freezing responses. Together, these results shed light on the expanding roles of CRFs in roots and flowering. We are generating crosses of CRF5 with DR5::GUS and PIN::GUS to check if they regulate the auxin concentration gradient during lateral root development. We are also interested in looking at how CRF4 and CRF5 interact with the gibberellic acid pathway to regulate flower development.

Title: DLP 3D Printing Resin Analysis Directed Towards Porous Materials

Primary Author: Savannah Chai

Additional Authors:

Mentor: Lauren Beckingham

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Digital Light Processing 3D printing (DLP) has transformed additive manufacturing with the ability to produce more accurate models while still being relatively cheap, quick, and reproducible. As the name suggests, additive manufacturing has been refined for printing finer, more complex solids. However, there is a gap in the study of using this additive manufacturing focused on creating negative spaces. Utilizing this high resolution for channels and pores is more imperative for fields like carbon sequestration, filtration engineering, soil sciences, and other geosciences. In this research, six Anycubic resins and five FormLabs resins are tested for the surface energy via contact angle measurements and observed for the accuracy and resolution of fine printed characteristics as well as how the best resins perform in printing complex models of real substrate samples. Printer settings, cleaning methods, and curing processes are also defined and adjusted to optimize print resolution. These results can illuminate the ideal resins and printing procedures for numerous areas of study and provide references for future 3D printing applications.

Title: Influence of beef organ inclusion on nutritional density, quality, and consumer acceptability of ground beef

Primary Author: Savannah Douglas

Additional Authors:

Mentor: Jason Sawyer

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Consumer demand for beef products is driven by eating quality, affordability, and versatility. Developing value-added formulations that enhance nutritional density without compromising acceptability is essential. Organ meats are nutrient-dense beef byproducts that remain underutilized in human food systems. This study evaluated the effects of incorporating beef heart, liver, or kidney at 15% inclusion into ground beef on nutritional composition, quality characteristics, and consumer acceptability. Patties were formulated with no organ inclusion or with 15% heart, liver, or kidney and assessed for proximate composition, instrumental color, texture, cooking characteristics, and consumer sensory responses. Liver and kidney patties exhibited greater redness, chroma, and red-to-brown values ($p < 0.0001$). Liver and kidney inclusion reduced Allo-Kramer shear force, hardness, and chewiness compared with heart and control patties ($p < 0.0001$). Cooking loss decreased for all organ treatments ($p < 0.0001$), with no difference in cook time ($p = 0.4844$). Consumers rated kidney patties as juicier and more tender than other treatments ($p < 0.0001$), whereas liver patties received lower scores for overall liking, flavor, aroma, and texture ($p < 0.0001$). These findings indicate that 15% organ inclusion improves nutritional density while altering quality and sensory perception, with beef kidney showing the greatest potential but requiring optimization to maximize acceptability.

Title: Glutamate modulation to prevent chemotherapy-induced cognitive impairment and neuropathic pain

Primary Author: Savannah Perman

Additional Authors: Miranda Reed; Kristy Berry; Yulia Maxuitenko; Vasiliki Syropoulou; Iva Durdanovic;

Mentor: Miranda Reed

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Chemotherapy treatment is frequently accompanied by persistent nervous system side effects, including chemotherapy-induced neurocognitive impairment (“chemobrain”) and chemotherapy-induced neuropathic pain (CINP), both of which significantly reduce quality of life for cancer survivors. Doxorubicin, a commonly used chemotherapy for breast cancer, is strongly associated with long-lasting cognitive deficits and sensory disturbances, yet there are currently no approved preventative therapies. Growing evidence suggests that these adverse effects may be driven in part by dysregulated glutamate following chemotherapy-induced neuroinflammation. In particular, the cystine/glutamate antiporter (xCT) is upregulated in glial cells under inflammatory conditions, leading to excess extracellular glutamate that can disrupt synaptic plasticity and neuronal function. We propose to test whether pharmacological inhibition of xCT during chemotherapy can mitigate glutamate-mediated dysfunction and protect neural circuits involved in learning, memory, and sensory processing. Using a preclinical mouse model, animals will receive doxorubicin with or without novel, brain-penetrant xCT inhibitors. Following a washout period, hippocampal synaptic plasticity, a cellular correlate of memory, will be examined using electrophysiological recordings of long-term potentiation, alongside behavioral testing to assess cognitive performance. In addition, chemotherapy-induced neuropathic pain, including mechanical sensitivity measured with von Frey assays, will be assessed. Together, these studies aim to advance both the mechanistic understanding of chemotherapy-related nervous system toxicity and the development of targeted preventative strategies to improve the quality of life for cancer survivors.

Title: OFF-THE-SHELF ACCURACY OF WATER METERS USED TO MONITOR WATER CONSUMPTION IN COMMERCIAL POULTRY AND LIVESTOCK SYSTEMS

Primary Author: Savannah Webb

Additional Authors: Carson Edge;Jesse Campbell;Kelly Griggs;Jeremiah Davis;

Mentor: Jeremiah Davis

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Water consumption is a common parameter that is monitored across poultry and livestock production systems. Accurate measurements are needed to monitor health and disease, nutrition levels, and thermal homeostasis. Accuracy testing information is highly variable or missing across water meter brands. The objective of this study was to determine the accuracy of new off-the-shelf water meters used in commercial poultry and livestock production systems. Eleven meter-treatments were created from five brands (Arad, BarnTools, Carlon, Dwyer, and Zaxe), three-meter types (multijet, oscillating piston, and ultrasonic), and three sizes [16 x 20 mm, 20 mm, and 25 mm (5/8 x 3/4 inch, 3/4 inch, and 1 inch)]. The accuracy was calculated for 10 meters for each treatment for the maximum, intermediate, and minimum flow rates prescribed for the type and size of each meter. 96% of the mechanical meters tested passed the manufacturer-specified accuracies for all flow rates. Excluding one manufacturer, 95% of the ultrasonic meters tested passed the manufacturer-specified accuracies for all flow rates. Most brands performed well across meter sizes and were within their manufacturer-reported accuracy, supporting their suitability for poultry and livestock monitoring applications. This study is the first to evaluate the accuracy of water meters used in livestock production systems. Future work will evaluate trends in accuracy as water meters age.

Title: Functional connectivity of the Default Mode Network (DMN) in implicit emotional appraisal and reappraisal

Primary Author: Sean Connolly

Additional Authors: Jennifer Robinson;Ava White;William Simmons;

Mentor: Jennifer Robinson

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Emotional appraisal and reappraisal are often studied as explicit processes, though some evidence has suggested that implicit or more automatic processes may be more cognitively adaptive. It has been proposed that these implicit processes may operate from networks similar to those of explicit processes, but this has seldom been directly studied. One potential pathway highlights top-down regulation through hyperconnectivity of the default mode network (DMN), and the purpose of this study was to examine this hypothesis using 7 Tesla (7T) functional magnetic resonance imaging (fMRI). To evoke implicit appraisal/reappraisal, participants were shown negative video stimuli that were preceded by either a negative, positive, or neutral description. The CONN Toolbox was used to examine the effect of prompt condition on DMN connectivity with the rest of the brain. Compared to neutral prompts, videos preceded by negative prompts elicited greater connectivity of the DMN primarily to the frontal poles and gyri, and temporal lobe including the left hippocampus, while positive prompts elicited greater connectivity primarily to the frontal gyri and bilateral temporal gyri. Compared to positive prompts, negative prompting elicited greater connectivity in the bilateral occipital lobe, frontal gyri, and orbitofrontal cortex. The hypothesis that affectively charged prompts would be associated with greater DMN connectivity was supported, and results could suggest that frontal regions were providing increased cognitive control for DMN regions associated with the construction of emotionally charged narratives. The connectivity increases between the DMN and hippocampus in the negative prompt condition only could exemplify the disproportionate encoding of negatively emotionally charged memories compared to neutral or even positive memories. Taken together, these results highlight DMN-driven pathways that may be associated with threat processing and emotional memory development.

Title: Exploring "phygital" analytiques as a form of representation for the memory and emotion of space

Primary Author: Sean Joiner

Additional Authors:

Mentor: Eilis Finnegan

Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: The art of the analytique was practiced and refined by the Ecole des Beaux-Arts as early as the late 19th century, strongly originating from Hector d'Espouy and his work titled *Fragments d'architecture antique*. Today, the representational drawing, in its original medium and capacity, has become antiquated within architecture. This project aims to expand upon the drawing's storytelling abilities by implementing "phygital" workflows. Through these workflows, the collapsed two dimensions of original analytiques are challenged as physical and digital media such as photography and 3D printing are introduced. Centered on developing a triptych, the research uses work from Auburn University Rural Studio as case studies. The studio's renowned design-build history in Hale County, Alabama makes their work ideal models for this multi-modal workflow and representation type, which provide perspective on the impact of community and time on built structures. Critical fragments of the cases are chosen to be illustrated beyond their geometry and ornament in order to explore how these entities shape the structures as beings. When visiting the studio, photos, notes, and audio recordings are taken in examination of the conditions, construction, and maintenance of the projects. This step informs a selection of three case studies: Perry Lakes Park Pavilion, Corrugated Cardboard Pod, and Antioch Baptist Church, which represent the physical states of prime, decay, and repair to reflect the purpose of the analytique. The information gathered on-site is brought into "phygital" workflows as sketching, collaging, and mapping bases, which are compounded with physical overlays such as 3D prints and scans to construct the triptych. Therefore, this research revives historically linked documentation with new forms of architectural representation and archival practices to encourage an understanding of the impact of architecture on a community in terms of memory and emotional connection.

Title: When AI enters the workplace: Stress responses as a pathway to employee deviant behavior

Primary Author: Selim Bakir

Additional Authors: Baker Ayoun;

Mentor: Baker Ayoun

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: Artificial intelligence (AI) is increasingly embedded in hotel operations, reshaping work processes and influencing employee behavior. While prior research has primarily examined how AI transforms workplace structures, less is known about how employees respond to AI integration and adoption and how these responses shape organizational outcomes. Drawing on the Transactional Theory of Stress and Coping and the Job Demands–Resources model, this study develops a dual-path framework to examine the effects of AI adoption and AI technology integration on employees' deviant behavior. Data were collected from 512 hotel employees in the United States. The findings indicate that AI adoption is associated with lower levels of employee deviant behavior, whereas AI technology integration is associated with higher levels of employee deviant behavior. In addition, both AI adoption and AI technology integration are positively related to a competitive psychological climate, which mediates their relationships with employee deviant behavior. In contrast, technostress does not mediate. By moving beyond dominant narratives centered on AI-driven job replacement and insecurity, this study offers a more nuanced understanding of employees' behavioral responses to AI in hospitality settings. Theoretical contributions, practical implications, and directions for future research are discussed.

Title: Asthma Burden and Environmental Exposures Among Families in Rural Alabama

Primary Author: Seoyeong Kim

Additional Authors:

Mentor: Linda Gibson-Young

Department/Program: COSAM Administration

College: College of Sciences and Mathematics

Abstract: Asthma is a chronic respiratory disease that remains a significant public health challenge in rural Alabama, where environmental exposures and social determinants of health contribute to poor disease control and disruptions to daily life. Families in rural and low-income communities often face increased exposure to indoor asthma triggers such as mold, pests, and inadequate housing conditions, as well as outdoor air pollution related to proximity to high-traffic areas. Despite these risks, limited research has examined how environmental asthma triggers affect daily functioning among rural families. This study analyzed survey data from 45 participants enrolled in the HEAL study to examine household environmental asthma triggers, exposure to outdoor air pollution, and asthma-related impacts on daily activities, school and work participation, and sleep among families in rural Alabama. Nearly half of participants (47%) reported at least one environmental asthma trigger in the home, most commonly mold (27%), followed by pests, water leaks, and inadequate heating or cooling. In addition, 40% of participants reported living near heavy traffic. These exposures were associated with notable disruptions to daily life. More than half of families (56%) reported recent asthma symptoms and limitations in physical, social, or daily activities. One-third (33%) experienced school or work disruptions due to asthma, and 63% reported nighttime symptoms that interfered with sleep. Findings highlight the substantial burden of environmental asthma triggers on health, daily functioning, and quality of life among families in rural Alabama. Interventions that address environmental risks alongside social determinants of health are urgently needed. Community Health Worker-led education and support may be an effective strategy to reduce asthma triggers, improve self-management, and decrease asthma-related disruptions in rural communities.

Title: Role of preexisting immunity in shaping the evolutionary dynamics of H1N1 influenza A virus in the porcine model

Primary Author: Shakiba Kazemian

Additional Authors: Constantinos Kyriakis; Miria Ferreira Criado; Moriah Derryberry; Peter James Neasham; Fletcher North;

Mentor: Constantinos Kyriakis

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Seasonal influenza vaccines display variable effectiveness, largely due to viral evolution driven by immune pressure. Understanding how pre-existing immunity influences influenza A virus (IAV) mutation patterns in natural hosts is essential for improving vaccine design. This study examined how prior vaccination with human- or swine-origin influenza strains affects viral evolution following H1N1pdm09 challenge in pigs. Eight-week-old, IAV-seronegative piglets (n = 6 per group) were assigned to one of three groups: vaccinated with (a) a human bivalent (huBIV) or (b) a swine bivalent (swBIV) inactivated IAV vaccine containing H1 and H3 virus subtypes, combined with a squalene-based human grade adjuvant, or (c) left unvaccinated as controls. Six months post-vaccination, all pigs were challenged intranasally with 10⁷ TCID₅₀ of A/CA/07/2009 (H1N1pdm09). Nasal swabs were collected for viral sequencing using Oxford Nanopore with a novel primer scheme, and resulting viral genomes were analyzed for single nucleotide polymorphisms (SNPs) and minor variants. Viral genome coverage was high across all segments, confirming the efficacy of the sequencing approach for clinical samples. Multiple nonsynonymous mutations were detected in hemagglutinin, neuraminidase, and polymerase genes. Distinct SNP patterns were observed among cohorts, with huBIV animals showing limited diversity, likely due to homologous immunity, while swBIV and naïve groups exhibited higher frequencies of mutations in receptor-binding and antigenic sites. Several identified substitutions have been historically associated with receptor affinity and antibody escape, consistent with post-2009 human H1N1 evolution. These findings demonstrate that pre-existing immunity shapes the evolutionary trajectory of IAV in swine, influencing the frequency and nature of adaptive mutations. This model provides a valuable platform for studying influenza evolution under immune pressure and could inform predictive models for vaccine strain selection.

Title: Integrating multi-sensor remote sensing and machine learning for general drought monitoring in the southeast United States

Primary Author: Sharmin Sultana Toa

Additional Authors:

Mentor: Luke Marzen

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Drought is a compound environmental hazard resulting from interactions between deficit of water in the atmosphere and land surface responses, including vegetation stress and soil surface moisture dynamics. To monitor both meteorological and agricultural drought in an integrated manner, this study establishes a general drought index for the Southeast United States using multi-sensor remote sensing indicators combined with ensemble machine learning techniques. Meteorological drought forcing represented by satellite-based precipitation estimates, and vegetation condition by the Normalized Difference Vegetation Index (NDVI) or Enhanced Meteorological Index (EVI). Land Surface Temperature (LST) was applied to reflect thermal stress, and Evapotranspiration (ET) was used to present surface moisture loss, and land atmospheric water exchange. All indices standardized and adjusted to ensure consistent drought directionality. Random Forest (RF) framework was used to capture the nonlinear relationships between these remote sensing indicators and independent drought reference data, standardized meteorological drought indices, and soil moisture observations. The trained models were used to merge climate driven drought signals and land surface responses into one composite drought index. Results demonstrate that the proposed index effectively captures the spatial and temporal evolution of drought and shows strong agreement with both meteorological and agricultural drought indicators. By explicitly integrating precipitation, vegetation, thermal, and moisture indicators through ensemble machine learning, this study highlights the value of remote sensing driven, data adaptive approaches for comprehensive drought monitoring in humid and semi humid regions.

Title: Optimization of Fused Deposition Modeling (FDM) Parameters and Design for High-Performance 3D Printed Woven Textiles

Primary Author: Shree Ghimire

Additional Authors:

Mentor: Sabit Adanur

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Additive manufacturing (AM) has revolutionized modern manufacturing through rapid prototyping and sustainable production, yet its application in creating flexible, textile-like structures remains challenging due to a persistent trade-off between strength and flexibility. This study investigates the optimization of Fused Deposition Modeling (FDM) process parameters and fabric designs to enhance the mechanical performance of 3D printed woven structures using Polylactic Acid (PLA) filament. Employing a Taguchi L9 orthogonal array for efficient experimental design, the research evaluated three primary variables across three levels: fabric design (2/1 twill, 2/2 basket, and 2/2 warp rib), layer height (0.2, 0.3, and 0.4 mm), and extrusion temperature (205, 220, and 235 °C). We performed comprehensive mechanical characterization via tensile and flexural testing in both warp and weft directions. Statistical analysis using MINITAB revealed that distinct parameters governed different mechanical properties: layer height emerged as the most significant factor for tensile strength, while fabric design played a dominant role in determining the tensile modulus, or rigidity. The results further highlighted a marked directional anisotropy in the printed structures; for example, optimized warp tensile strength reached 33.27 MPa, almost four times higher than the weft strength of 8.35 MPa. Additionally, we identified extrusion temperature as the critical parameter influencing flexural performance in the warp direction. By identifying optimal parameter combinations—such as utilizing basket designs for maximum strength and twill designs for enhanced flexibility—this research provides a foundational roadmap for developing customizable, high-performance, and scalable 3D printed textile applications.

Title: Spray Deposition and Uniformity within the Corn Canopies for Drone Fungicide Applications

Primary Author: Shubhdeep Singh

Additional Authors: Eros Francisco; Steve Li; Simer Virk;

Mentor: Scott McElroy

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Fungicide application in corn is an important strategy to minimize the risk of fungal diseases such as southern rust, northern leaf blight, and southern leaf blight. Aerial application of fungicides in corn with manned aircraft is a common practice in the US. Recently, spray drones have received considerable attention and are being used for fungicide applications in corn. However, limited information on spray deposition and the efficacy of fungicides applied with spray drones is available. Therefore, a two-year study to assess spray deposition and penetration in the corn canopy was conducted in 2023 and 2024 at the tasseling stage using two commercial spray drones, DJI Agras T30 and T40. For the T30, spray deposition was assessed at different positions within the canopy at two rates of 18.7 and 46.7 Liters per hectare ($L\ ha^{-1}$) at varying heights (2.2, 3, 3.8 m). For the T40, spray applications were conducted for both volumes at a fixed height of 3 m. In another study, fungicides were applied in plots using the DJI T30 at spray volumes of 18.7 and 46.8 $L\ ha^{-1}$, and disease control and yield were recorded from all plots. Spray deposition was collected using water-sensitive paper (WSP) placed at different canopy positions, and disease efficacy data were collected by providing disease ratings in each study plot. Spray coverage ranged from 0.2% to 3.4% and was highly variable ($CV > 37\%$) across the swath and within the corn canopy, regardless of the spray volume, application height, and drone type. Coverage and droplet density increased with spray volume across both drones. Higher spray volume also had better control over common fungal diseases, while no effects on total yield were observed. These findings can help the corn growers to optimize their fungicide application methods for better control of corn diseases.

Title: The effects of psychosocial stress on EMD of the lower leg during isometric fatiguing contractions

Primary Author: Sierra Eady

Additional Authors: Michael Zabala; Ivan Nail Ulloa; Savita Pareek;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Exoskeletons are assistive devices worn on existing limbs to augment or replace human motion. The rejection of these devices has been linked to human-robot interaction (HRI) and psychosocial stress. Biosignals, such as electromyography (EMG), are often used in exoskeletons to improve the HRI. When prioritizing synchronization in exoskeletons utilizing EMG, electromechanical delay (EMD) – the time between a muscle receiving a signal to move and motion initiation – should be considered. EMD dictates the amount of time available to receive data, make calculations, and move the device so that it does not inhibit the wearer's motion. Studies have found that EMD is affected by many physiological factors, but none have studied the effect of psychosocial stress. This study aimed to investigate the impact of psychosocial stress on EMD during isometric fatiguing contractions in the antagonistic muscle pair at the ankle. Thirteen healthy participants wore EMG sensors on their tibialis anterior (TA) and gastrocnemius medialis (GM). They performed two sets of isometric contractions by plantarflexing or dorsiflexing against a hook-and-loop strap and an array of force sensitive resistors. Between the first and second set of contractions, the participants performed the Trier Social Stress Test resulting in pre- and post-stress values. The difference between pre- and post-stress EMD for the first trial of the GM was found to be statistically significant ($p < 0.05$) using two-tailed Wilcoxon signed rank tests. The first two trials of the TA were found to be statistically equivalent using the two one-sided t-tests method at a 90% confidence interval and 25% equivalence threshold. Additionally, EMD was found to increase with fatigue before the stress inducing task and decrease with fatigue after. The results suggest psychosocial stress has some effect on EMD for the TA and GM during isometric fatiguing contractions and that this may need to be considered when designing exoskeletons.

Title: From data to decisions: using near real-time geospatial data to track, monitor, and manage land in an adaptive way

Primary Author: Sinka Khadijah Abubakar

Additional Authors: Jonathon Valente; Lana Narine;

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Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Adaptive management is a science-based, iterative approach to management that improves outcomes by learning from results and adjusting strategies based on new information. This approach necessitates continuous updates based on real-time data, which static models and products are incapable of providing. In 2008-2010, the Alabama Department of Conservation and Natural Resources (ADCNR) initiated a statewide wildlife inventory, linking species distributions with habitat characteristics to set long-term management targets. ADCNR then applied a grassroots management approach to implement these strategies. However, ADCNR currently does not have a tool to help them track these goals, other than using costly field surveys. Using freely available satellite imagery, ancillary data and open tools like R Studio, we trained a Random Forest model for ADCNR's lands to delineate their landscapes into 11 management-relevant landcover categories, achieving ~90% accuracy. To make our spatially comprehensive workflow accessible and user-friendly to local land managers, we developed an interactive R Shiny web application called Landcurate. This application is designed to classify land cover on these lands using our pre-trained model. It enables users to upload a shapefile defining an area of interest and specify a year for analysis, then receive an output of land cover for that area and year. By leveraging freely available remote sensing data and machine learning, Landcurate will transform complex classification workflows into an interactive platform that supports real-time use. This interface bridges the gap between technical expertise and day-to-day management, empowering land managers to assess habitat dynamics and adapt conservation strategies to meet long-term goals.

Title: Heat applied by an automated robotic system acts as a maintenance treatment in the control of Varroa destructor in honey bee (*Apis mellifera*) colonies

Primary Author: Skyler Demi

Additional Authors: Geoffrey Williams; Agostina Giacobino;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Varroa destructor is an ectoparasitic mite on honey bees, identified as a leading cause of recent record high colony losses. Varroa mite populations are developing increasing resistance to amitraz, a synthetic chemical used for mite control. This growing resistance has intensified the need for safe and effective mite control strategies, including non-chemical methods. Heat treatment applied to developing honey bees directly targets Varroa mites, whose lower thermotolerance allows the heat to kill them while the bees survive. Brood-targeted heat treatments have been considered impractical due to labor and time demands, but the BeeHome™ system automates application using a robotic arm and artificial intelligence, reducing these burdens for beekeepers. However, this treatment has not been tested against a standard chemical treatment in a large-scale field study. Here we show that automated heat application to brood is comparable to standard treatment. From March to May 2025, we evaluated Varroa mite infestation rate – defined as the number of mites per 100 adult honey bees – and colony strength for colonies kept in BeeHomes™ under field conditions. They were treated with either the Beewise Heat Chamber, VarroSan®, a standard chemical treatment, or an untreated control. We found that Varroa infestation rates were maintained in the heat chamber (2.1% to 2.8%) and VarroSan® (2.4% to 3.9%) groups throughout the study, while the untreated control rose from 1.8% to 7.7%. At the end of the study, infestation rates were significantly higher in the untreated control than in both heat treatment and VarroSan® groups ($p = 0.0004$; $p = 0.0401$). Heat treatment did not affect colony strength or survival. Our results demonstrated that the heat chamber controls Varroa as effectively as VarroSan® and shows that automated brood-targeted heat treatment can provide beekeepers with a non-chemical Varroa mite control option.

Title: Effects of Norroa™ on Varroa destructor population growth within hygienic Pol-line *Apis mellifera* colonies during the fall

Primary Author: Smith Easton

Additional Authors: Geoffrey Williams;Agostina Giacobino;Selina Bruckner;

Mentor: Selina Bruckner

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Persistent *Apis mellifera* colony losses, commonly attributed to the parasite *Varroa destructor*, have been a prevalent issue for beekeepers. As these mites are continuously treated with chemicals, increasing levels of resistance to synthetic miticides have been observed. Current management recommendations ask beekeepers to apply miticides at specific *V. destructor* thresholds, rotating treatments throughout the year. Depending on how rapidly thresholds are reached, the interval between treatments may be short, possibly resulting in repeated use of the same treatments which can reinforce resistance. Thus, it is crucial to investigate alternatives to manage *V. destructor* and keep current treatment options useful. We addressed this by testing the newly registered RNAi-based treatment Norroa™, and its effectiveness alongside hygienic Pol-line queens in the south-eastern United States from August 2025 to February 2026. While they have been demonstrated as effective against *V. destructor* separately, there is a knowledge gap in how they interact. By investigating their effectiveness independently as well as in conjunction, we addressed this gap which will allow for better management recommendations. Through regular colony assessments, mite washes, and brood uncapping, we will determine how the selected treatments affect colony strength as well as *V. destructor* infestation and population.

Title: Zinc-catalyzed $2e^-$ redox chemistry for Ni(IV/II) diethyldithiocarbamate couple

Primary Author: Smriti Somai

Additional Authors: Maynard Marlow;

Mentor: Byron Farnum

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Redox Flow Batteries (RFBs) are excellent candidates for grid-scale applications because they are easily upscaled and are safer to use than Lithium-Ion Batteries (LIBs). Currently, RFBs have lower energy density than LIBs. Multi-electron redox chemistry of molecules at a single potential can be leveraged to increase the energy density of RFBs. Nickel(II) N,N-diethyldithiocarbamate (Ni(II)(dtc)₂) undergoes two-electron ($2e^-$) ligand coupled electron transfer to [Ni(IV)(dtc)₃]⁺ upon oxidation and reforms Ni(II)(dtc)₂ when reduced. Cyclic Voltammetry (CV) experiments in MeCN/TBAPF₆ show a single $2e^-$ oxidation wave while reduction displays two sequential $1e^-$ waves. The anodic process occurs through an ECE-DISP 1 mechanism where E is electron transfer, C is a chemical step and DISP is disproportionation. In contrast, the cathodic process occurs through an EEC mechanism. Addition of zinc salts coalesced the reduction waves into a single $2e^-$ reduction wave changing the mechanism to ECE, where the chemical step is catalyzed by Zn(II). Zinc salts used are Zn(ClO₄)₂, Zn(BF₄)₂, ZnCl₂, ZnBr₂, Zn(NO₃)₂ and Zn(OTf)₂. While all Zn salts enhanced $2e^-$ behavior, there are differences in the rate of the chemical step due to coordination geometry around the Zn(II) ion. CV and square-wave voltammetry (SWV) were used to study electrochemical mechanisms. Nuclear Magnetic Resonance (NMR) and UV/Vis spectroscopy were used to study the binding of Zn(II) to Ni(II)(dtc)₂. ZnCl₂ bonded weakly to Ni(II)(dtc)₂ because of strongly coordinating Cl⁻ ions and the slowest rate constant, while Zn(NO₃)₂ bonded strongly. Zn(BF₄)₂ had the fastest rate constant for the chemical step. Adding Zn(II) also affected the anodic wave by forming an encounter complex observed by a second oxidation peak. This work highlights the key role of the chemical step in facilitating overall $2e^-$ Ni(IV/II) redox cycle and shows that Zn(II) ions can serve as catalysts in both the oxidation and reduction directions.

Title: The impact of shoulder rotation on fastball velocity and elbow valgus torque in collegiate pitchers

Primary Author: Sofia Byrd

Additional Authors: Gretchen Oliver; Benjamin Lerch; Ian Jump; Ryan Zappa;

Mentor: Gretchen Oliver

Department/Program: School of Kinesiology

College: College of Education

Abstract: In baseball, pitchers aim to maximize pitch velocity to challenge batters. Achieving higher velocity often involves increasing shoulder external rotation (ER), thereby extending the arm's range of motion and allowing greater distance to accelerate. While previous research has shown that shoulder maximum ER (MER) is associated with peak elbow valgus torque (pEVT), no study has examined this relationship through continuous analysis. Therefore, this study investigated the impact of shoulder rotation on pEVT and fastball velocity during pitching. Motion capture data were collected using an 8-camera markerless system (300Hz) on 252 NCAA Division I pitchers (1.89 ± 0.06 m, 92.38 ± 10.30 kg, 90.71 ± 2.73 mph). Data were collected during NCAA-sanctioned games. Sidearm pitchers (arm slot ≥ 90) were excluded due to their kinetics being incomparable to overhand pitchers. Kinematic data from each participant were interpolated to 101 data points, from foot contact to ball release (BR), and trials were averaged. Ball velocity and pEVT were averaged for each participant. Statistical parametric mapping (SPM) regressions ($\alpha = .05$) were performed to assess the influence of shoulder rotation on pEVT and fastball velocity. SPM analysis revealed that greater shoulder ER approaching MER ($79.6 \pm 2.7\%$), from 54.72-80.41% of the pitching motion, was associated with greater ball velocity ($p = 0.015$, $R^2 = 0.047$). However, greater ER approaching MER and BR, from 44.53-80.53% and 90.87-100.00%, was associated with lower pEVT ($p = 0.004$, $R^2 = 0.053$). Greater shoulder ER before and at MER is associated with greater ball velocity and lower pEVT, yet only a small percentage of variance in pitch velocity and pEVT is explained by shoulder ER. Additionally, greater shoulder ER leading up to BR is associated with lower pEVT. Since higher pEVT places greater stress on the medial elbow and increases injury risk, our results suggest that greater MER may benefit pitchers by reducing pEVT while still increasing pitch velocity.

Title: Light-induced activity changes alter foraging tunnel construction in termite workers.

Primary Author: Solana Hosburgh

Additional Authors: Nobuaki Mizumoto;

Mentor: Nobuaki Mizumoto

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Light is an important cue for insects to determine behaviors, such as phototaxis, a movement in response to surrounding light sources while navigating environments. Because termites are blind and live primarily in complete darkness, they exhibit negative phototaxis and avoid light. Additionally, the activity of subterranean termites is suppressed by light conditions. However, it is still untested how this light-induced activity change results in the difference in group-level behaviors, such as underground tunnel development for foraging. We tested how light conditions affect tunneling behavior in two subterranean termites, *Reticulitermes flavipes* and *Coptotermes formosanus*, both of which are major structural pests. We hypothesized that exposure to light suppresses termite foraging activity, leading to reduced tunnel development (shorter length, fewer branches, lower complexity) in both species. We conducted multiple 24-hour tunneling cycles in both light and dark conditions in a clear sand arena. Data was manually measured, and we compared tunnel length and branching patterns as well as differences between the two species using Python-based software. Our preliminary data indicates that termites reduced tunnel construction under light conditions, and the number of branches was also reduced. We also found that *C. formosanus* excavated more sand tunnels than *R. flavipes*, and *C. formosanus* was more sensitive to light. This study provides materials for further exploration of light sensitivity in worker termites and the effects of light environments on foraging behaviors.

Title: The Supplemental Nutritional Assistance Program Benefit Cycle and Mental Health

Primary Author: Sonia Afrin

Additional Authors: Alicia Powers;Joel Cuffey;Kara Newby;

Mentor: Joel Cuffey

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Low-income households in the United States receive monthly food benefits from the Supplemental Nutrition Assistance Program (SNAP). These benefits are issued over a period of 20 days each month, and households receive their benefits on different days of the month. Some households exhaust their benefits before the end of the benefit cycle, which can lead to food insecurity and poor mental health later in the month. This study investigates the relationship between the SNAP benefit cycle and recipients' mental health. We conducted an online survey of SNAP participants in Alabama to measure mental health using the 10-item Depression Anxiety Stress Scale (DASS-10). We estimated Ordinary Least Squares regressions to examine the pattern of distress across the benefit cycle. Our results show that overall distress rises significantly after day 21 of the benefit cycle. Additionally, the disaggregated analysis of the DASS-10 scale yields consistent findings: anxiety-stress and depression scores also increase in the later part of the cycle, paralleling the overall distress result. As an extension, we further assess whether SNAP nutrition incentives can mitigate psychological distress and find only limited effects. These findings highlight the psychological strain of benefit depletion and thus underscore the need for policy interventions.

Title: Assessment of Biochar, Alum, and Iron Sulfate on Nutrient retention and DOC-Associated leaching in Poultry Litter amended Soils

Primary Author: Soura Gupta

Additional Authors: Debolina Chakraborty;

Mentor: Rishi Prasad

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Introduction: Excessive poultry litter (PL) application can cause nitrate (NO₃-N) and phosphate (PO₄-P) leaching. While amendments like alum and iron sulfate reduce nutrient mobility, they contribute to soil acidification. Biochar (BC) act as a sustainable nutrient adsorbent, but the comparisons between BC and chemical amendments, alongside the role of dissolved organic carbon (DOC) in leaching, remain understudied. Materials and Methods: A pot experiment was conducted with coarse textured soil in open field condition in 20 leaching columns using corn as a test crop. Five treatments were used, consisting of a control (soil only), soil with 20 t ha⁻¹ PL application, soil amended with PL in combination with three types of amendments: BC, alum, and iron sulphate (all at 10% w/w relative to PL), replicated four times. Leachate NO₃-N, PO₄-P, and DOC were analyzed across five rainfall events. Yield, biomass, and nutrient uptake were measured. Results: In Unamended PL, NO₃-N and PO₄-P concentrations were 0.53–51.5 and 0.88–20.5 mg L⁻¹, respectively. In BC, alum, and iron sulfate soils, NO₃-N ranged 1.72–39.2, 1.07–22.1, and 1.55–46.7 mg L⁻¹; PO₄-P ranged 3.18–13.6, 1.51–8.25, and 1.99–11.6 mg L⁻¹. Amendments significantly reduced PO₄-P loads ($p < 0.05$) but not NO₃-N. DOC correlated with NO₃-N ($r=0.54$, $p<0.05$) and PO₄-P ($r=0.83$, $p<0.001$). Grain yield was similar between unamended and BC soils, but significantly higher than alum and iron sulfate treatments. Conclusion: Leaching was strongly influenced by crop growth stages and rainfall amounts. PO₄-P retention followed the order: iron sulfate > alum > BC. NO₃-N retention was modest and event-dependent. Strong associations between DOC and leaching suggest DOC is a key indicator of nutrient mobility.

Title: Subseasonal drought cascades across the United States land–atmosphere system

Primary Author: Sudhanshu Kumar

Additional Authors: Di Tian;

Mentor: Di Tian

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Droughts are often explored as isolated meteorological, agricultural, hydrological, or ecological phenomena, yet their interconnected evolution at subseasonal timescales remains poorly understood. This study investigates how droughts emerge, interact, and propagate within the coupled land–atmosphere system at subseasonal time scales. We introduce an event-based framework that applies event-coincidence analysis to detect drought events as persistent anomalies in the precipitation–evapotranspiration balance, soil moisture, runoff, and vegetation condition across the contiguous United States from 1982 to 2025, using satellite observations and land data assimilation system outputs. Our analysis reveals directional dependencies and time-lagged transitions among drought types, indicating that meteorological anomalies frequently act as initiators that trigger subsequent agricultural, hydrological, and ecological droughts. Spatially coherent propagation pathways are identified, linking drought source regions to downstream sink regions through statistically significant lead–lag relationships. Recurrent cross-variable transitions are observed in several climate-sensitive areas, such as progression from atmospheric water deficit to soil moisture depletion and vegetation stress in the Southern Plains, with characteristic lags of several weeks. The strength and lag of these cascades vary regionally and are strongly modulated by large-scale atmospheric circulation patterns, as evidenced by associated near-surface temperature anomalies, wind fields, and 850-hPa geopotential height. These results suggest that subseasonal drought evolution is governed by directional temporal cascades and non-local spatial linkages within the land–atmosphere system, offering new insights into drought predictability and early-warning potential at subseasonal scales.

Title: Investigating a curcumin metabolite as a neuroprotective agent against neurodegeneration

Primary Author: Suhrud Pathak

Additional Authors: Satyanarayana Pondugula;Keyi Liu;

Mentor: Muralikrishnan Dhanasekaran

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Curcumin, the active bioactive in *Curcuma longa* (turmeric), is far and wide acclaimed for its potent pharmacodynamic properties and minimal adverse effects. It has been significantly used globally as a nutraceutical, dietary supplement, and cosmetic agent for both prophylactic and therapeutic functions. Nonetheless, its low bioavailability has limited its clinical efficacy. To overcome this constraint, contemporary research has changed to curcumin metabolites, which often display equal or enhanced biological action. Among these, tetrahydrocurcumin (THC) has developed as a promising candidate with prominent therapeutic promise. This study investigates the novel neuroprotective properties of THC using both in silico and in vitro methods. Neuronal viability was assessed in HT-22 (hippocampal) and N27 (dopaminergic) neurons. To elucidate the mechanisms underlying THC's neuroprotective effects, several biomarkers were evaluated, including oxidative stress, mitochondrial function, inflammation, and apoptosis. Additionally, cholinergic markers, acetylcholinesterase (AChE) and choline acetyltransferase (ChAT), as well as dopaminergic markers, tyrosine hydroxylase (TH), aromatic L-amino acid decarboxylase (AADC), monoamine oxidase (MAO), and catechol-O-methyltransferase (COMT), were examined. THC demonstrated significant, dose-dependent neuroprotective effects in both neurons, largely attributable to its antioxidant, anti-apoptotic, and mitochondrial-protecting actions. These findings were further analysed by RNA sequencing analysis, which validated the bioactive metabolite's neuroprotective impact at the molecular level. Collectively, these results highlight THC as a promising natural bioactive metabolite with potential applications in the prevention, progression delay, and treatment of neurodegenerative disorders.

Title: Exploring oncolytic virus therapy to target osteosarcoma

Primary Author: Sumbul Khan

Additional Authors: Emma Logsdon;Isabella Shimko-Lofano;Terri Higgins;

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Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Osteosarcoma (OS) is a highly aggressive and metastatic bone malignancy that primarily affects children and young adults. Despite advances in multidisciplinary treatment, including surgery, chemotherapy, and radiation therapy, the survival rates for patients with OS have not improved significantly over the past 20 years, especially for those with metastatic disease. We hypothesize that combining cancer immunotherapies will have better therapeutic potential for osteosarcoma. We have successfully combined two immunotherapeutic modalities by developing armed canine conditionally replicative adenoviruses (CAV2-AU-M3). CAV2-AU-M3 is armed with an immune checkpoint inhibitor, an antibody to PD-1 that is released into the tumor microenvironment (TME) upon lysis. We have evaluated the oncolytic activity and production/ secretion of anti-PD1 Ab by CAV2-AU-M3 in four canine OS cell lines, D17-GLP, CF11-GLL, D22-GLP, and MCKOS in 2D and 3D cultures. We have also assayed the production and secretion of anti-PD1 Ab in cell culture media, which binds to the PD1 receptor and plays a role in inhibiting PD1-PDL1 binding. CAV2-AU-M3 represents a next-gen approach to immunotherapies in solid tumors and creates a blueprint to guide the development of similar treatments in solid tumors such as osteosarcoma.

Title: Understanding Geographically Isolated Wetland Hydrology with NASA SWOT: A Validation Study from the Dougherty Plain, GA

Primary Author: Suranjana Chatterjee

Additional Authors: Kathryn Perkins;

Mentor: Frances O'Donnell

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Geographically Isolated Wetlands (GIWs) are waterbodies that lack direct surface connections to perennial rivers or streams, yet they play critical roles in landscape hydrology, nutrient cycling, and biodiversity. Their small size, dynamic hydroperiods, vegetation cover, and hydrologic disconnection make them difficult to monitor using traditional remote sensing platforms such as MODIS or Landsat. This study evaluates the performance of the NASA Surface Water and Ocean Topography (SWOT) mission in capturing water surface elevation (WSE) and inundation patterns of GIWs in the Dougherty Plain, Georgia, USA. SWOT-derived WSE from pixel cloud products was compared with high-frequency field-measured water level data from five GIWs with varying size, vegetation cover, and catchment characteristics. WSE was calculated from the nearest classified water pixel after applying geoid correction and filtering based on classification and geolocation quality flags. Correlation with field data was generally weak for wetlands dominated by sedge and grass marshes, likely due to interference from floating vegetation. After applying strict pixel-cloud filtering to include only open-water pixels, SWOT-derived WSE for an open-water wetland showed strong agreement with field observations ($R^2 = 0.91$), while marsh sites exhibited moderate agreement ($R^2 = 0.79$). Analysis of pixel cloud classifications revealed frequent misclassification of inundated areas as land, particularly along vegetated margins; in one GIW, over 79% of pixels were misclassified within the observed inundation zone. These findings demonstrate both the potential and current limitations of SWOT products for small, vegetated wetlands. Ongoing work focuses on developing a hybrid approach that integrates bathymetry, field observations, and pixel-level filtering to improve WSE estimation and hydroperiod characterization in GIWs.

Title: Can biochar mitigate ammonia emissions within the broiler house?

Primary Author: Susan Gabriela Garcia Castro

Additional Authors: Debolina Chakraborty;

Mentor: Debolina Chakraborty

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The US is one of the world's largest producers of poultry meat. However, a persistent challenge in broiler production is the excessive generation of ammonia (NH_3) within broiler houses. Environmental factors such as pH, moisture, and temperature can accelerate NH_3 volatilization, which can adversely affect bird health, reduce productivity, and compromise overall air quality. Sodium bisulfate (commonly marketed as PLT) is widely used to suppress NH_3 emissions; however, its corrosive properties may pose risks to both humans and birds, and its effectiveness is often short-lived. Biochar, a carbon-rich material with high adsorption capacity, has emerged as a potential alternative for retaining NH_3 in broiler litter (BL). Its performance, however, varies with feedstock type, pyrolysis conditions, and production temperature. Therefore, the objective of this study was to evaluate the effectiveness of pinewood biochar, applied at different rates, in reducing NH_3 emissions from BL. The experimental design included two amendments (biochar and PLT), two application rates, and a control (BL alone), each replicated three times. All treatments were incubated at 30 °C for 40 days under a moisture content of 40% (w/w). Ammonia emissions were measured regularly throughout the incubation period. Amendments were characterized before and after incubation for pH, total carbon (TC), and total nitrogen (TN). BL initially had a pH of 7.5, with TN and TC concentrations of 3.4% and 35.5%, respectively. Results showed that NH_3 emissions were higher in the biochar-amended treatments compared to both the control and the PLT treatments, regardless of application rate. These findings suggest that the pinewood biochar used in this study did not effectively mitigate NH_3 volatilization under the tested conditions. Additional research is needed to determine how different biochar feedstocks, production conditions, and application rates influence ammonia emissions in broiler houses.

Title: Sustainability Without Sacrifice: Rethinking Luxury in Residential Interior Design.

Primary Author: Susan Mann

Additional Authors:

Mentor: Anna Ruth Gatlin

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: High-end residential interiors often prioritize luxury, comfort, and convenience over environmental performance and occupant wellness. Despite growing interest in sustainability, luxury homes are frequently excluded due to the perception that sustainable design compromises aesthetics. This project was conducted as design research supported by precedent case study analysis and performance-based modeling. Precedent homes were selected based on three criteria: verified sustainable construction methods, integration of wellness-focused features, and recognition within the luxury residential market. These projects were evaluated for material selection, energy systems, spatial planning strategies, and their overall aesthetic approach. Using insights from the precedents, a prototype luxury residence was developed. Floor plans and 3D models were analyzed to test passive design strategies, daylight optimization, natural ventilation, and material lifecycle considerations. Performance analysis focused on projected energy efficiency improvements, reduced embodied carbon through material selection, and enhanced indoor environmental quality, including daylight access and air flow. Compared to a luxury home of similar size, the prototype demonstrates improved energy performance, lower-impact material use, and increased occupant wellness potential while maintaining traditional design aesthetics. Within sustainable architecture, traditional styles are often overlooked in favor of minimal interiors, yet this study demonstrates that homes can achieve long-term coexistence with the terrain while using traditional approaches such as Modern-Cottage and Provincial French styles. Due to their scale and economic influence, integrating sustainability into luxury residences has major environmental potential, but restricting it to minimal-modern aesthetics leaves much of the market excluded.

Title: Psychosocial stress, campus resources, and student wellbeing at Auburn University

Primary Author: Susan Osayande

Additional Authors:

Mentor: Vanessa Harrison

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Student wellbeing is increasingly recognized as a multidimensional construct linked to students' academic engagement, persistence, and overall development. However, institutional indicators of student success often emphasize academic outcomes, providing limited insight into the psychosocial conditions that shape students' wellbeing. This study examined associations between psychosocial stressors, campus resources, and student wellbeing using data from the Wellbeing Improvement Survey for Higher Education Settings (WISHES), a campus-wide survey administered to students at Auburn University. Drawing on frameworks from student development and the social determinants of health, this analysis focused on financial stress, loneliness, and sense of belonging as key psychosocial factors. Student wellbeing was operationalized using two outcomes: flourishing and self-rated mental health. Multiple regression analyses were conducted to examine direct associations between psychosocial factors, campus resources (including recreation and wellness services, peer support, mentoring, faculty care, and engagement), and wellbeing outcomes, as well as whether campus resources moderated the effects of psychosocial stressors. Preliminary findings indicated that several campus resources were positively associated with student wellbeing, with some resources demonstrating stronger associations than others. Findings suggest that while campus resources contribute to wellbeing, broader structural and psychosocial conditions may play a more prominent role. This study contributes to the literature by highlighting the complexity of resource and wellbeing relationships and the importance of multidimensional, empirically grounded approaches to understanding student wellbeing in higher education.

Title: Tropilaelaps vs. Varroa: Comparing population growth of two important honey bee parasitic mites

Primary Author: Sven Aurell

Additional Authors: Geoffrey Williams; Lena Barascou; Rogan Tokach;

Mentor: Geoffrey Williams

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The honey bee parasitic mite *Tropilaelaps mercedesae* is poised to upend apiculture, much as the mite *Varroa destructor* has done in recent decades. As *Tropilaelaps* mites are spreading to new areas of Asia and into Eastern Europe, the knowledge gaps around *Tropilaelaps* mites are becoming a global concern. It is thought that *Tropilaelaps* mites reproduce faster than *Varroa* mites in *Apis mellifera* honey bee colonies, yet concrete evidence at the colony level is lacking. Without knowledge of *Tropilaelaps* mites' population growth, we cannot adequately compare the threat posed by the two mites, nor estimate how frequently beekeepers will need to control *Tropilaelaps*. To address this knowledge gap, we evaluated *Tropilaelaps mercedesae* population growth in three studies in Thailand and South Korea. We did so by estimating whole-colony mite populations in untreated colonies ($n = 39$) at the start and end of monitoring periods in which mite populations were allowed to grow. We found that *Tropilaelaps* mites had an average daily rate of increase (r) of 0.04 across these studies, corresponding to a 10.8-fold population increase over 2 months. In contrast, a representative *Varroa* mites daily r of 0.021 corresponds to only a 3.5-fold population increase over the same period. Compared to *Varroa* mites, populations of *Tropilaelaps* mites grow rapidly to levels that cause colony damage and drive dispersal to new colonies. Implications for beekeepers' mite control practices will be explored.

Title: UAV-Based remote sensing and machine learning for monitoring brown spot needle blight

Primary Author: Swati Singh

Additional Authors: Lana Narine;

Mentor: Lana Narine

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Brown Spot Needle Blight (BSNB) is an emerging needle disease affecting loblolly pine (*Pinus taeda*) in the southeastern United States, with implications for timber productivity and forest health. Conventional detection methods are labor-intensive and limited in spatial coverage. Remote sensing may offer scalable, efficient alternatives for early detection and severity assessment; however, its direct application to BSNB remains poorly explored. This study had two objectives: (1) to conduct a systematic review of remote sensing-based approaches for BSNB and similar needle diseases, and (2) to evaluate the efficacy of unmanned aerial vehicle (UAV)-based multispectral imaging combined with machine learning for BSNB severity mapping. First, we performed a bibliometric analysis using the Web of Science database and VOSviewer to identify thematic trends, research gaps, and methodological limitations. We also investigated the potential of multispectral UAV data for BSNB detection, using *P. taeda* stands in Washington and Cullman counties in Alabama, as a case study. Individual trees were classified into four BSNB severity categories (healthy, early, moderate, severe) using Support Vector Machine (SVM) and Artificial Neural Network (ANN) classifiers. Based on the comprehensive literature review, we found few BSNB-specific remote sensing studies, limited use of high-resolution UAV imagery, and scarce integration of machine learning with field data. These gaps informed the case study using multispectral UAV data over *P. taeda* stands. In the case study, models for BSNB severity delineation achieved high accuracy, with SVM and ANN reaching 94.79% and 94.00% accuracy in Washington County, and 94.94% and 94.89% in Cullman County, respectively. Kappa coefficients ranged from 0.80 to 0.92 for SVM and 0.80 to 0.89 for ANN. This study addresses gaps in UAV-based BSNB research by presenting a GIS-integrated multispectral and machine learning framework for forest health assessment.

Title: Linking human development, harmful algal blooms and cyanotoxin production in Lake Jesup, FL, USA over the last 150 years

Primary Author: Sydney Burge

Additional Authors: Troy Clift;Kathryne Bowling;

Mentor: Matt Waters

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The development of harmful algal blooms (HABs) in shallow lake ecosystems can cause dramatic reductions in ecosystem services, including anoxia, fish kills, and cyanotoxin production. Whereas cyanotoxin production is generally linked to cyanobacteria abundance, the triggers of cyanotoxin production (nutrients, temperature, grazing, and allelopathy) are still being determined. Here, we conducted a paleolimnological sediment core analysis to explore the onset and development of harmful cyanobacteria dominance and cyanotoxin production in Lake Jesup, FL, USA. Lake Jesup, located in central Florida, is a large, shallow lake with a history of harmful algal blooms and the cyanotoxin cylindrospermopsin. Lake Jesup has received excess nutrients from poor wastewater management and fertilizer runoff following the urbanization of central Florida during the 1960s. Our sediment core was dated using ^{210}Pb , and each core section was analyzed for nutrients, cylindrospermopsin, and algal pigments. Results show that, while urbanization contributed to a cyanotoxin spike, cyanotoxin concentrations reached harmful levels before Seminole County was developed. Comparing cyanotoxin concentrations with nutrient data, algal pigments, and various elements suggests that a combination of biogeochemical and lake characteristics drives temporal changes in cyanotoxin production. These findings will be useful for identifying human activities that have decreased water quality over time and for future management of Lake Jesup and other lakes in central Florida with comparable water quality concerns.

Title: Targeting PPAR subtypes: a novel approach to combat aggressive prostate cancers

Primary Author: Sydney Hamilton

Additional Authors: Robert Arnold;Rajesh Amin;Sarah Batten;

Mentor: Robert Arnold

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Prostate cancer is the 2nd leading cause of cancer-related mortality in men in the United States. Despite existing treatment strategies, prostate cancers (PCa) eventually develop resistance and metastasize, effectively circumventing traditional treatment methods. Therefore, there is a need for more effective treatment options for resistant and advanced-stage disease. One emerging therapeutic option for advanced prostate cancer is targeting peroxisome proliferator-activated receptors (PPARs), a family of receptors with multiple subunits (α , β , δ , and γ), involved in the expression of genes related to adipogenesis, metabolism and inflammation. The anticancer effects of PPARs are varied, and there are large gaps in our knowledge surrounding their importance. This study focused on PPAR- γ agonists. Activating PPAR- γ has demonstrated tumor-suppressing effects and could potentially slow the progression of prostate cancer (PCa). Here, we evaluated the antitumor efficacy of novel PPAR- γ agonists, developed at Auburn University, in castration-resistant metastatic human prostate cancer cell lines (DU145) and its' taxane-resistant variant (DUTXR). These findings highlight the potential for combining topotecan with PPAR- γ agonists with differing subunit selectivity as a therapeutic strategy for the treatment of prostate cancer. The potency (IC₅₀) of each compound was determined, and transcriptomic analysis (RNA-seq) was performed. These findings highlight that PPAR- γ agonists exhibit antitumor activity in PCa cell lines. More importantly, they have the potential to modulate cellular metabolism and other pathways, thereby enhancing the efficacy of traditional anticancer agents and offering a promising new approach for improved cancer treatment strategies. Future studies will test these combinations in additional PCa cell lines and patient-derived organoids, using 3D models that are more physiologically relevant and provide greater insight into their anticancer effects.

Title: Applying the Policy Triangle Framework to Understand the Role of Policy in the Alabama Food System

Primary Author: Sydney Rookes

Additional Authors: Sara Gonzalez;

Mentor: Sara Gonzalez

Department/Program: Human Sciences Administration

College: College of Human Sciences

Abstract: Alabama has the fifth-highest rate of food insecurity in the United States. Food insecurity is a persistent public health issue that is exacerbated by low food access in areas that need it most. The key to increasing food access and decreasing food insecurity is strong, resilient local food systems. Food systems are networks of stakeholders from all areas including producers, processors, packagers, charities, grocery stores, schools, and more. Policy has been identified as an important avenue for making effective changes in the branches of the food system. However, despite the importance of policy, limited research has been done to evaluate the current policies that affect the Alabama food system specifically. This research explores how the branches of the food system are affected by, and engage with, state-level food-related policies. This study addresses the gap in the research by analyzing the current state of Alabama food systems policy through document review and stakeholder interviews. Policies were collected from databases such as Westlaw, NexusUni, and the Alabama Administrative Code. Policies were then analyzed using the Policy Triangle Framework, which examines policy for content, context, process, and actors. Stakeholders, who work in a variety of fields in the food system, were chosen to interview by purposive sampling. These interviews gathered data on how and why specific policies came to be, and the power dynamics that influence Alabama's policies. Interview transcripts were analyzed via thematic analysis with the software Nvivo. This study identified existing food systems policies in Alabama, examined how stakeholders were involved in the policy development process, and how those same policies impact the daily operations of the food system. The findings aim to increase stakeholder awareness of current policies and provide food-system-specific insights to inform future policy in the hopes of ultimately reducing food insecurity in the state of Alabama.

Title: ZBP1 drives early interferon- β induction during murine cytomegalovirus infection

Primary Author: Sydney Spindler

Additional Authors: Jason Upton;Olivia Brahms;

Mentor: Jason Upton

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Z-nucleic acid Binding Protein 1 (ZBP1) senses viral infections to help prompt host antiviral defenses. While it has an established function in promoting programmed cell death, its potential role in driving antiviral signal transduction and the production of interferon- β (IFN- β) remains controversial. Murine cytomegalovirus (MCMV) has a biphasic relationship with IFN- β , displaying an early peak within hours of infection, which is then inhibited as viral gene expression rises, and then a second peak later in the infection. Here, we provide evidence that ZBP1 is required for the induction of interferon- β (IFN- β) and the activation of interferon-stimulated genes (ISGs) during the early phase of MCMV infection. Infection of murine endothelial cell lines lacking ZBP1 with MCMV revealed a marked delay in the induction of Guanylate Binding Protein 2 (GBP2), a gene that is highly upregulated by IFN- β . Stable reconstitution of the cells with wild-type ZBP1 restored basal levels and the early upregulation of GBP2 during MCMV infection, indicating that ZBP1 is necessary for the early upregulation of IFN- β driving GBP2 expression. However, reconstitution of cells with ZBP1 lacking the C-terminal domain fails to restore early GBP2 induction, suggesting that the C-terminal domain is critical in mediating this response. Future experiments will focus on determining the mechanisms that ZBP1 uses to control early IFN response and characterize those responses during MCMV infection. This work provides evidence that ZBP1 controls the early cellular anti-viral responses to MCMV infection and adds further definition to the role of ZBP1 in host protection.

Title: Productivity vs. Burnout: The Mental Health Consequences of Academic Technology

Primary Author: Taeheon Kim

Additional Authors: Kyeongseo Park;Hyunwoo Lee;

Mentor: Myounggi Chon

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Recently, a growing trend has been observed in which college students increasingly rely on artificial intelligence (AI) in their academic and daily lives. There is no doubt that AI is easily accessible and is being integrated into education, and interest has grown in exploring how AI influences students in both positive and negative ways. Although AI is often praised for improving efficiency and supporting learning, its broader impact on students' academic development, social relationships, and mental well-being remains unclear. This study aims to investigate the relationship between Auburn University students' use of AI and their life balance. This study focuses on three key research topics: (1) How does increased use of AI-based academic technology affect college students' social health? (2) How does frequent reliance on AI and digital academic tools influence college students' mental health outcomes? (3) How does the use of artificial intelligence study tools influence students' actual knowledge acquisition and retention of academic material? To address these questions, data will be collected using Qualtrics five-point Likert scale survey, along with qualitative data. The survey will be designed to directly address each of the three research questions by assessing students' patterns of AI use, perceived academic performance, social interactions, and mental well-being. As artificial intelligence continues to play a growing role in higher education, understanding its influence on students' academic, social, and mental well-being has become essential. This study aims to better understand how students' use of AI affects their academic routines without increasing stress, burnout, or negative impacts on social and mental health.

Title: How User Input Mode and Chatbot Accuracy Shape Customer Experience: Click vs. Text Matters!

Primary Author: Tahseen Tawseef

Additional Authors:

Mentor: Wis Kwon

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: AI-powered chatbots are transforming customer services by enhancing efficiency and personalization while reducing costs for businesses. However, chatbot response accuracy remains a key challenge. Regardless of whether the chatbot response inaccuracy is due to a fundamental AI competency failure or a simple conversational flow design error, it can impact customer experience. A chatbot may collect users' input either by letting them to use natural language (i.e., text-based input) to describe their requests or by presenting pre-defined request options on which users can click (i.e., click-based input). We hypothesize that these two user input modes may evoke varying expectations of the chatbot's performance in the user's mind; specifically, users may expect a higher level of chatbot response accuracy when they click on an option presented by the chatbot than when they describe their request in their own words (Hypothesis 1), because they understand that AI may sometimes misunderstand human language while expecting that AI would not mistake in understanding the request pre-defined by itself. According to the expectancy violation theory, when an outcome is not expected but the outcome transcends the user's expectation (a behavior or trait that surpasses a partner's expectations positively, demonstrating communication that is better than anticipated), users evaluate this positively, which is called a positive violation. On the contrary, when an outcome is expected but results are undesirable; then this scenario is called negative violation. Therefore, according to this theory, we propose that, users have a higher expectancy about a chatbot's performance when a click-based (vs. text-based) user input mode is used. (Hypothesis 2) and the higher the expectancy about a chatbot's performance, a) the lower the positive expectancy violation and b) the higher the negative expectancy violation perceived by users. (Hypothesis 3). We will conduct a 2 (chatbot performance: accurate vs. inaccurate) $\times$ 2 (user input method: click vs. text) between-subjects experiment to examine these hypotheses. Findings from this study will provide new insights into how user input modes shape consumers' satisfaction with a chatbot's performance through an expectancy confirmation/disconfirmation mechanism, bridging a gap in AI-consumer behavior research through a new theoretical lens. The findings will help businesses design more effective chatbots to enhance user experience and trust.

Title: The effect of sleep on Tau and Beta Amyloid accumulation in 3xTg mice and its implications for Alzheimer's disease development and treatment

Primary Author: Tara Flynn

Additional Authors: Henry Limbo;Eva Ortiz-Feder;Daniel Kroeger;Menaka Marasinghe Mudiyansele;Mohottala;Natasha Wendy Grabau;Jillian Manville;

Mentor: Daniel Kroeger

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Alzheimer's disease (AD) is a neurodegenerative disease that affects an estimated 7.2 million Americans aged 65 and older. Mechanistically, AD is characterized by the accumulation of beta-amyloid (A β) and tau proteins, which subsequently leads to neurodegeneration. Recent studies suggest that sleep may play a critical role in the accumulation of these proteins by regulating brain-waste removal, a process called glymphatic drainage. In this study, we will use female 3xTg mice, an extensively studied AD model that expresses both A β and tau, to assess the effects of sleep on AD progression. To increase natural sleep, we will chemogenetically activate GABAergic neurons in the Ventral Medial Midbrain/Pons (VMP), which are part of the brain's natural sleep circuitry. After increasing sleep for 60 days, we will quantify changes in AD biomarkers in 3xTg and control mice with and without VMP GABA activation using immunohistochemistry (IHC). Specifically, we will employ antibodies targeting soluble, insoluble, and total A β and tau to assess the accumulation and localization of these proteins in different brain regions. We hypothesize that increased sleep will be associated with decreased overall A β and tau accumulation. Future aims will use behavioral tests to evaluate cognitive functioning after sleep treatments. These results will provide insight into sleep-based treatments for AD in humans.

Title: Refinement of methodology for measuring standard metabolic rate in freshwater mussels (Unionidae)

Primary Author: Tatum Osmon

Additional Authors: Jim Stoeckel; Hannah Adkins;

Mentor: Jim Stoeckel

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: The United States boasts the highest diversity of freshwater mussels in the world, and these animals are important for filtering pollutants and waste from our rivers and waterways. Metabolism has been used as a metric in conservation plans for mussels due to its importance to mussel health. Standard metabolic rate (SMR; the lowest level of aerobic metabolism required to maintain physiological function of organs in the absence of activity and digestion) is a foundational parameter that has been used in defining optimal temperatures, measuring hypoxia tolerance, and predicting resource allocation in other aquatic taxa, but existing protocols for estimating SMR in fish and crayfish are not sufficient to use with mussels. SMR is estimated from measurements of respiration rate over time, and existing protocols identify “high” values in these datasets that are due to periodic activity and thus, must be excluded. In mussels, it would be inaccurate to only remove “high” values because they also periodically close and switch to anaerobic respiration – resulting in “low” values that are not representative of SMR. Our study’s goal was to develop and validate a SMR protocol that identifies and removes these “low” values as well as any “high” values. Respiration rates of 47 mussels were measured for 24 hours using intermittent flow respirometry, and statistical methodologies used in fish and crayfish were modified to identify “low” respiration measurements presumably caused by closure events. Preliminary results indicate that our modified protocol successfully identifies and excludes both “low” and “high” values from estimation of SMR. This protocol can be used by others to attain accurate estimates of SMR in mussels which can be used for determination of metabolic endpoints and various energy-budget models. Freshwater mussel ecophysiology is an emerging field, and updated research techniques for assessing environmental quality are critical for ongoing conservation efforts.

Title: Nurture over Nature? Maternal and Environmental Influence on Wild Zebra Finch Eggshell Morphology

Primary Author: Taylor ODell

Additional Authors: Haruka Wada; Ben Haussmann; Brooklyn Ehlers;

Mentor: Haruka Wada

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Avian eggshells act as the first line of defense for developing embryos and are vital for regulating gas exchange and water loss. Variations in features such as pore density and shell thickness can affect the embryo's survival and development. Prior studies found zebra finches housed at 35°C decreased the eggshell thickness, showing the ambient temperature mothers experience can impact eggshell morphology. Nonetheless, maternal influences and external environmental factors that affect eggshell characteristics in wild populations remain poorly understood. In this study, we examined the effects of ambient temperature on wild zebra finch eggshell morphology. To measure pore density and eggshell thickness, three locations were sampled from each egg: the blunt pole, the equatorial zone, and the acute pole. We tested how the average maximum ambient temperature 1, 3, and 7 day(s) prior to the egg being laid affected pore density and thickness. We found ambient temperature did not impact pore density or eggshell thickness. However, maternal ID was included in our statistical models and we found that maternal effects explain 29.5% of the variation in pore density and 59.2% of the variation in eggshell thickness. Overall, this suggests that maternal effects influenced shell morphology to a greater degree than temperature in this population. The strong maternal effect suggests that individual females consistently differ in the way they build their eggs. It is also possible that the lack of effect of temperature on shell morphology is because females did not experience temperatures extreme enough to cause plasticity in shell morphology during this study. There are many other factors that could shape avian eggshell morphology, such as differences in microclimates, physiology, age, genotype, or nutrition. Therefore, further studies should test how eggshell morphology varies with more extreme temperatures and the mechanisms behind maternal effects, such as genetics and physiology.

Title: How effective is biochar optimization for controlling phosphorus release dynamics in agricultural systems?

Primary Author: Temitope Popoola

Additional Authors: Oladiran Fasina;Dexter Watts;H Torbert;Debolina Chakraborty;

Mentor: Rishi Prasad

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Improving phosphorus (P) use efficiency while minimizing its loss remains a fundamental challenge in agroecosystems. Conventional fertilization strategies often result in low P recovery by crops and increased P loss to surface waters. This study investigates biochar as a dual-function material that not only reduces excess P loadings through adsorption from runoff but also controls its release for sustainable agricultural use. It is hypothesized that physicochemical modifications to biochar alter surface functional groups, mineralogy, and elemental properties, thereby enhancing P sorption, hysteresis behavior, and controlled desorption potential. Adsorption-desorption experiments were conducted using three biochar variants (untreated, DI-washed, and Fe-modified) to quantify P sorption maxima and release dynamics across sequential desorption cycles. Fe-modified biochar exhibited the highest sorption maxima (S_{max} : 1250 mg kg⁻¹), followed by DI-washed (1181 mg kg⁻¹) and untreated variants (310 mg kg⁻¹). Desorption studies revealed a major difference: Fe-modified biochar released <0.1% of sorbed P, DI-washed released ~10%, and untreated released ~63%, indicating strong retention in Fe-modified samples. An incubation experiment mimicking field conditions of high-P coastal plain sandy soil confirmed that Fe-modified biochar reduced cumulative water-extractable P by up to 34%, compared to the control, while DI-washed biochar provided moderate retention and controlled release, offering agronomic benefits. These findings demonstrate that Fe-modification substantially enhances P immobilization, whereas DI-washing offers a cost-effective alternative for balancing environmental protection and agronomic nutrient availability. This research introduces a material-informed soil amendment strategy that enhances soil fertility and improves water quality, providing a foundation for further field applications of modified biochar.

Title: Restoration of fertility in gene-edited channel catfish (*Ictalurus punctatus*) at hypothalamic-pituitary-gonadal axis related loci

Primary Author: Teresa David

Additional Authors: Rex Dunham; Ian Butts; Nadeen Abdo; Brendan Leibert; Kieran Stein; Kailyn Shealy; David Baker; Ahmed Elewa Shaaban; Baofeng Su; Misha Soman; Dhanuka Bambaranda Hewage; Homnath Dhakal; Darshika Udari Hettiarachchi; Kate Pottle; Mei Shang;

Mentor: Rex Dunham

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Reproduction in Channel catfish (*Ictalurus punctatus*) can be improved by gene editing some of its major reproductive genes. These gene-edited broodfish can be used without causing potential harm to the wild fish population by disrupting a key reproductive gene, Gonadotropin Releasing Hormone (GnRH) which is located within the hypothalamic-pituitary-gonadal (HPG) axis. The absence of this reproductive gene makes channel catfish incapable of breeding when they escape into the wild population. This current study aims to temporarily restore fertility using hormone induction, thereby maintaining broodstock population and producing fry needed to meet with the demands of fish farmers. Channel catfish which were gene-edited for their reproductive genes were induced to spawn in tanks with implants coupled with 1200, 1600 and 2000IU of human chorionic gonadotropin (HCG) or equine chorionic gonadotropin (ECG) delivered, while a baseline control was induced to spawn with implants only. This resulted in 55.0% spawning, and 69.7% hatching rate. Statistical analysis indicates that ECG is no more or less effective than HCG for spawning of gene edited channel catfish. A combination of implants and HCG hormone induced spawning appears to be a feasible option to restore fertility for channel catfish sterilized by editing HPG axis related genes.

Title: Adult ESL learners: How they can be effectively assessed

Primary Author: Teresa Lee

Additional Authors: Yuan Zhang;

Mentor: Gwendolyn Williams

Department/Program: Department of Curriculum and Teaching

College: College of Education

Abstract: This presentation discusses the learning process of two groups of adult ESL learners in the US, focusing on their tutoring experiences and post-tutoring assessment procedures. One group (2 students) was enrolled in a university-affiliated program (Auburn Global) and the other group (1 student) participated in a community-based program. According to previous research, assessment practices a teacher implements are likely to be influenced by the educational context in which s/he teaches. In general, college-based ESL programs have instructional goals that are more in line with the expected academic standards whereas community-based ESL programs set goals that are to help learners become successful in their daily activities (e.g., ordering foods) to be done in English. After 10 one-hour weekly tutoring sessions, the two groups were assessed in the following four language skill areas: listening, reading, speaking, and writing. For the college group, the tests were created to tap into the students' academic readiness. Yet, for the community group, the tests were created to measure the students' ability to use English in real-life situations: navigating daily interactions, communicating needs clearly, and engaging confidently in practical, community-based contexts. From this presentation, attendees will learn more about the following: 1) how to create tests that are appropriate to different educational contexts, 2) how to properly interpret assessment results and give meaningful advice to learners for further improvement, and 3) what ESL programs are available in Alabama.

Title: Development of CAR T cells to target osteosarcoma in a canine model

Primary Author: Theresa Higgins

Additional Authors: Blake Moseley;Sumbul Khan;

Mentor: Payal Agarwal

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Osteosarcoma (OS) is an aggressive, highly metastatic, and difficult-to-treat bone cancer that occurs predominantly in children and adolescents but also has a high occurrence rate in dogs. There have been no major breakthroughs in treatment or significant increases in survival rates since the introduction of chemotherapy in the 1970s. The rise of immunotherapies, such as CAR T-cell therapies, holds promise as a new treatment modality for difficult-to-treat cancers, including osteosarcoma. We have developed anti-B7H3 CAR T cells for the treatment of osteosarcoma in a canine model. We have demonstrated the cytotoxic effects of anti-B7H3 CAR T cells in four OS cell lines: D17-GLP, CF11-GLL, MCK-OS, and D22-GLP. Cell killing was clearly enhanced in all four cell lines when co-incubated with anti-B7H3 CAR T cells as compared to non-transduced T cells. We further aim to assess the cytotoxic effects of anti-B7H3 CAR T cells in a 3D model across all four cell lines. This study provides insight into the use of CAR T-cell therapy in solid tumor treatment and provides a critical avenue for translational impact in human medicine.

Title: Canine fecal microbiome alterations associated with experimental *Cystoisospora* spp. infection

Primary Author: Theresa Quintana

Additional Authors: Jeba Jesudoss Chelladurai;

Mentor: Jeba Jesudoss Chelladurai

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: *Cystoisospora* spp. are among several primary etiologic agents responsible for diarrhea in young dogs, but have historically been understudied. The relationship between *Cystoisospora*-associated diarrhea and alterations in the gut microbiome is currently unknown. We hypothesized that infection with *Cystoisospora* spp. leads to alterations in the fecal microbiome of dogs. To evaluate this, we experimentally infected a cohort of 8 research beagles with a mixed inoculum containing *Cystoisospora canis* and *C. ohioensis* complex. We collected fecal samples daily in the morning from May 22nd through July 5th, 2024 (45 consecutive days). A portion of each sample was immediately frozen at -80°C until DNA extraction, while the remaining portion was used for diagnostic analyses. We quantified oocyst load using the Mini-FLOTAC technique, with an analytical sensitivity of 5 oocysts per gram (OPG). In this study, the prepatent period for *C. ohioensis* was 4–5 days, while that for *C. canis* was 8–10 days. Dogs were treated with ponazuril either on day 8 (group 1) or day 13 (group 2) post-infection. We extracted DNA from the frozen fecal samples and submitted them for 16S region V4 microbiome profiling using Illumina next-generation sequencing. The QIIME2 pipeline was used for bioinformatic analysis. We present the microbiome data spanning the 45-day period. Analysis revealed that microbial composition was largely individualized, with some overlap in community structure across dogs in the same treatment group and of the same sex. Significant variation in dysbiosis-associated bacterial taxa was observed between individuals and treatment groups. Group 2 showed increased *Streptococcus* and decreased *Peptacetobacter hiranonis*, along with significantly higher Shannon diversity (4.15 ± 0.02 SEM vs. 4.00 ± 0.03 SEM; $p = 0.0000087$, $r = 0.23$) compared to Group 1. These findings suggest that *Cystoisospora* spp. infections may contribute to dysbiosis in dogs. Further studies are warranted to elucidate the underlying mechanisms driving these microbial shifts and to assess the impact of therapeutic interventions.

Title: Determining the hydrologic regime of river shoals: An important habitat for the Cahaba Lily

Primary Author: Thomas Lynch

Additional Authors: Christopher Anderson;

Mentor: Christopher Anderson

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: *Hymenocallis coronaria*, commonly known as the Shoal Lily, is a rare and endangered aquatic plant endemic to South Carolina, Georgia, and Alabama. The species is restricted to river shoals located along the fall line - the geomorphic transition between the Piedmont and Coastal Plain - where it occupies shallow, fast-flowing waters with stable substrates. Because *H. coronaria* inhabits such a narrow ecological niche, it is highly sensitive to alterations in stream hydrology caused by damming, channelization, or flow regulation. However, little is known about the specific hydrological conditions that support stable, reproducing populations, limiting our ability to guide conservation or reintroduction efforts. To better characterize suitable hydrologic conditions, we used flow records from three USGS-gauged streams with well documented *H. coronaria* populations to estimate their long-term (15-yr) daily flooding records. We used historical aerial imagery (i.e., Google Earth) to estimate shoal flooding at known dates across a range of flow conditions (as measured at the nearest USGS gauge) and matched that with 15-yr flow data to develop a rating curve of shoal flooding and river flow at each river. We quantified the seasonal pattern of inundation and shoal exposure at each site supporting a healthy *H. coronaria* population focusing on the month of May, which is a critical period for this species. This approach provided a baseline for assessing the frequency, duration, and magnitude of inundation events that coincide with *H. coronaria* growth and flowering periods. These results are expected to support *H. coronaria* management and restoration decisions.

Title: Spectrochemical investigation of the break-in effect of ProDOT (OE)-DMP

Primary Author: Trevor Hayes

Additional Authors: Caitlyn Clark; Christopher Grieco;

Mentor: Christopher Grieco

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: ProDOT (OE)-DMP is a conjugated polymer useful in bioelectronic applications due to its biocompatibility and ability to conduct both ionic and electronic charge. When in use in electrochemical devices, the polymer exhibits a break-in effect, where a change in structure enables greater ionic transport, resulting in enhanced conductivity. Understanding the break-in effect of the polymer allows for deeper insight into the dynamics of the doping process, which could help with the design of more consistent electronic devices. To study this break-in effect, this research uses cyclic voltammetry (CV) and absorbance spectrophotometry, which both initiate and record changes that occur during the doping process. CV was used to dope the polymer, while its voltammogram showed a drastic change in both the shape and the oxidation onset after the first cycle due to break-in. In addition, both the absorbance spectra and kinetics recorded during CV exhibited drastic changes after the first cycle, with the changes stopping after the seventh cycle. The unique changes in both the CV and kinetics indicate structural changes at the molecular level that directly impact the polymer's electrical properties.

Title: Influenza A Virus surveillance in commercial swine farms: Identifying interspecies transmission risk

Primary Author: Trinity Beell

Additional Authors: Constantinos Kyriakis;Miria Ferreira Criado;Laura Huber;Fletcher North;Alik Kalpourtzidou;Dimitrios Sakkas;Shakiba Kazemian;Moriah Derryberry;Camryn Mattox;

Mentor: Constantinos Kyriakis

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Swine are a critical natural host in the evolution and ecology of Influenza A Viruses (IAVs). Swine IAVs belong to the H1N1, H1N2, and H3N2 subtypes, and they often share hemagglutinin (HA) and/or neuraminidase (NA) proteins with previously circulating seasonal human IAVs. Importantly, pigs are susceptible to both avian and human strains, making them a mixing vessel for the generation of novel viruses. This contributes to the evolution of IAVs and the emergence of interspecies transmission in swine farms. In collaboration with Prestage Farms, we are performing active and passive surveillance for IAVs in pigs and farm workers in 12 swine farms, 6 in Mississippi and 6 in Iowa, monthly, for one year. Each month, we receive a nasal swab from each farm manager and 10 oral fluid samples from each farm's pigs to screen for active infections. Viruses from PCR-positive samples will be isolated in MDCK cells and sequenced using the iSeq 100 (Illumina) platform. Additionally, we are testing serum samples from swine to identify infections that have occurred retrospectively. With every sample, associated metadata is collected. We are tracking potential risk factors, including respiratory disease history, production practices, various exposures, vaccination status, and farm-size attributes. Using this metadata, we will identify risk factors for interspecies transmission to inform strategies for mitigating IAV spillover events. As of January 2026, we have received 84 sample collection boxes, including 840 oral fluid samples from swine, 120 serum samples, and 84 nasal swabs from 10 different farm personnel. 33/840 (3.93%) swine oral fluid samples were marked positive by RT-qPCR. These correspond to IAV outbreaks in 7 farms. Our preliminary sequencing data show the circulation of various H1 and H3 subtype viruses. These findings are consistent with data from the United States Department of Agriculture (USDA) nationwide swine influenza surveillance network.

Title: Beyond broadband: Poverty, race, and telehealth use in rural communities

Primary Author: Uchenna Udoji

Additional Authors: Tannista Banerjee; Linda Gibson-Young;

Mentor: Tannista Banerjee

Department/Program: Department of Economics

College: College of Liberal Arts

Abstract: Rural communities face persistent healthcare access barriers, including limited provider availability, transportation challenges, and resource shortages. Telehealth innovations like OnMed CareStations offer potential solutions, yet factors influencing their utilization remain understudied. This study examines the effects of socioeconomic conditions on telehealth utilization by demographic characteristics. We analyzed 997 OnMed consultations across five rural Alabama counties (Greene, Hale, Lafayette, Sumter, and Wilcox) between January and October 2025. Using fixed effects and pooled OLS regression models, we estimated the impact of county-level conditions on utilization rates (consultations per 1,000 population). The analysis reveals significant health disparities, including counties' poverty rates 10.9 percentage points higher than Alabama averages, a 36.6 percentage point overrepresentation of Black residents, and 57.7% of users lacking a primary care provider. A central finding was a strong negative relationship between poverty and utilization, with each percentage point increase in poverty reducing consultations by 0.951 per 1,000 population. However, this poverty effect was significantly moderated in communities with high Black population shares, reducing the barrier by approximately 75%. This reveals that while poverty significantly hinders telehealth adoption, predominantly Black areas demonstrate greater resilience, partially overcoming these barriers through community-level factors. Achieving equitable access, therefore, requires a dual approach, such as implementing targeted support for digital literacy and technology in high-poverty regions, while actively learning from and leveraging the strengths of community networks that facilitate higher utilization. These findings advocate for equity-focused telehealth policies that combine infrastructure investment with community-engaged strategies to reduce access disparities in rural populations.

Title: Targeting Astrocytic Glutamate dysregulation to prevent Doxorubicin induced cognitive impairment

Primary Author: Vasiliki Syropoulou

Additional Authors: Miranda Reed;Yulia Maxuitenko;Kristy Berry;Savannah Perman;Iva Durdanovic;

Mentor: Miranda Reed

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Chemotherapy-induced cognitive impairment (“chemobrain”) is a common, persistent side effect impacting many breast cancer survivors treated with doxorubicin (DOX). The mechanisms behind these cognitive deficits, particularly the short-term memory deficits, are not fully understood. However, our preliminary findings show that DOX impairs synaptic plasticity, the cellular correlate of memory, and short-term memory, linked to long-lasting changes in an astrocytic protein (xCT/SLC7A11) that regulates synaptic glutamate levels. Glutamate is essential for memory, but excess glutamate can be both detrimental to memory and cause cell death. In our animal model, we observed a significant, sustained increase in xCT four weeks after DOX exposure ended, suggesting a prolonged rise in extracellular glutamate that may underlie cognitive deficits. This study aims to determine whether DOX-induced glutamate dysregulation is driven by upregulation of astrocytic xCT, and whether novel xCT inhibitors can prevent these effects. Adult female mice will receive xCT inhibitors in combination with DOX for 5 weeks. Four weeks after treatment, we will assess glutamate levels, synaptic plasticity, memory, and changes in relevant synaptic and astrocytic proteins, as well as markers of cell death, using immunoblotting and immunohistochemistry. Additionally, to evaluate clinical relevance, a separate group of tumor-bearing mice will be used to test if xCT inhibitor co-treatment affects DOX’s antitumor efficacy in a triple-negative breast cancer model. The ultimate goal is to determine if targeting xCT can prevent cognitive impairment without reducing DOX’s cancer-fighting effectiveness, laying the foundation for clinical trials and new strategies to preserve brain health in patients undergoing chemotherapy.

Title: Speech recognition and perceptual decision-making in ADHD

Primary Author: Victoria Holcomb

Additional Authors:

Mentor: Susan Teubner-Rhodes Earp

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by inattention, hyperactivity, and impulsivity. Individuals with ADHD exhibit decreased accuracy in speech recognition in noise and display higher impulsivity linked to poor cognitive control. Recognizing speech in noisy environments may involve cognitive control to filter out irrelevant auditory information and select amongst activated phonological competitors. However, it is unknown how ADHD affects the application of cognitive control during speech recognition in noise. The present study aims to understand how ADHD influences the deployment of cognitive control during speech recognition in noise using a picture–speech recognition task designed to trigger cognitive control through phonological conflict. Native English–speaking participants ages 18–35 with or without a formal diagnosis of ADHD completed a speech-in-noise recognition task in which target words were presented against multi-talker babble alongside congruent or incongruent photorealistic pictures of objects to manipulate engagement of cognitive control. Congruent trials presented images that matched the spoken target word, whereas incongruent trials presented images that conflicted with the spoken word. Increased speech recognition accuracy following conflict indexed cognitive control–related improvements. Preliminary results showed that participants with ADHD exhibited a larger improvement in word recognition following conflict compared to healthy controls. This pattern reflected decreased accuracy on initial conflict trials in participants with ADHD relative to controls. Results suggest that young adults with ADHD may apply cognitive control reactively rather than proactively when recognizing speech in noisy environments. These findings may help explain everyday listening difficulties experienced by individuals with ADHD in noisy community settings. Further research may expand on these insights to develop strategies that support more effective learning in adverse listening conditions.

Title: From concept to pilot: Designing a human-subjects study for in-vehicle interaction

Primary Author: Vincent Lin

Additional Authors: Missie Smith;

Mentor: Missie Smith

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: This project shows the evolution of an experiment from conception through pilot study, along with the development and final selection of tasks for a user study. Beginning with a research topic focusing on driver distraction due to communication while driving, we realized that sometimes interaction with the car itself can also be a distraction. As in-vehicle technologies expand, drivers must interact with a growing mix of interface controls while safely driving. While prior research has examined individual forms of driver distraction, there is a lack of integrated frameworks that guide how in-vehicle tasks and functions should be allocated across input modalities. We address this gap by assessing four distinct in-vehicle interaction models that link interface design choices to cognitive, visual, and manual distraction and overall driver performance. This poster will focus on the experimental design process, task selection, and final outcomes from pilot study data. For this study, we will use a medium fidelity, fixed-base driving simulator and will report pilot data collected for a future study of twenty-four participants. In this pilot study, three drivers completed a driving-only task to establish a baseline, then performed a primary driving task while interacting with in-vehicle interfaces among four input modalities: touchscreens, dials, buttons, and touchpads. We collected measures including eye movement behavior, secondary task performance, participant preferences, and lateral and longitudinal driving performance. While further data analysis is ongoing, we present initial pilot results and a detailed plan for full-study analysis. Findings will support evidence-based design guidelines for safer in-vehicle systems. The primary focus of this poster, however, is to provide student researchers and early career faculty practical lessons learned from the process of building a user study from the ground up.

Title: High-dimensional mapping of age-dependent immune cell diversity in chickens

Primary Author: Vinicius Bottura Apolloni

Additional Authors: Miria Ferreira Criado; James Krehling;

Mentor: Miria Ferreira Criado

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: The chicken immune system comprises innate and adaptive components, with features that are both homologous to and distinct from those of mammals. Due to the limited availability of specific immunological tools, it remains poorly characterized. This study aimed to standardize a flow cytometry-based assay to phenotype immune cells at steady state from healthy chickens of various ages to support further animal investigations. To isolate peripheral blood mononuclear cells (PBMCs), fresh blood was collected from 6- and 8-week-old broiler chickens from Miller Center, Auburn University. PBMCs were obtained using Ficoll-Paque PLUS Medium, according to a standardized protocol. To obtain chicken macrophages and dendritic cells, PBMCs were seeded under GM-CSF or GM-CSF + IL-4 conditions for 3 days, respectively. Cells were adjusted to 1×10^6 per sample and analyzed on a Beckman Coulter CytoFLEX LX using multi-parameter flow cytometry panels designed with commercially available antibodies against chicken immune cell markers to assess classical (CD4+, CD8+ and CD4+ CD8+) and non-classical (CD3+ TCR-1+, CD3+ TCR-1+ CD8+) T cells, B cells (CD45+ BU-1+), natural killer cells (CD3- CD8+), thrombocytes (CD45+ CD41/61+), monocytes/macrophages (KUL01+ MHC-II+) and dendritic cells (CD1.1+ MHC-II+). Conventional multi-parameter flow cytometry panels targeting chicken immune cell markers were concatenated into t-distributed Stochastic Neighbor Embedding (t-SNE) maps, enabling the assessment of immune cell frequency and diversity in chickens of different ages at steady state. This approach provides a robust framework for high-dimensional immune profiling, revealing patterns of cellular distribution that may be difficult to detect with traditional analyses. Our data provides a foundation for future investigations under infectious or immunological challenge conditions.

Title: Improving ion transmission across the Funnel–SLIM interface through SIMION simulations with experimental validation

Primary Author: Viraj Gandhi

Additional Authors: Ahmed Hamid; Kimberly Kartowikromo;

Mentor: Ahmed Hamid

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Ion mobility spectrometry (IMS) has proven to be a potent method for analysis of complex molecular mixtures by providing quasi-orthogonal separation to mass spectrometry. As modern IMS platforms achieve increasingly high resolving power, overall performance is often limited not by separation within the mobility region, but by ion transmission efficiency into IMS, which directly reduces sensitivity. In this work, we investigate ion injection from an ion funnel into a drift-tube-based Structures for Lossless Ion Manipulation (SLIM) device across an interface gap upstream of the mobility region using both simulations and experiments. The system operates at 4 Torr, with ions exiting the funnel through a 2.5 mm diameter aperture and entering SLIM. Ion trajectories across this interface were studied using the SIMION simulation software package. We have utilized electric fields to explain the observed ion transmission differences as a function of the spacing gap between the funnel exit and SLIM entrance. Moreover, experimental measurements using a standalone funnel–SLIM platform confirmed the simulation trends, with ion transmission increasing at higher gap fields. A resolving power of approximately 27 was achieved at an axial field of 10.41 V/cm and 45 cm long SLIM, while arrival times and resolving power remained unchanged across gap field conditions, demonstrating that improved ion injection can be achieved without compromising mobility performance.

Title: Biochar-derived graphene oxide for green corrosion inhibitor applications

Primary Author: Vivian Chimezie Usha

Additional Authors: Hassan Khodaei Jalalabadi;

Mentor: Hossein Jahromi

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Corrosion of metallic infrastructure remains a persistent challenge across various sectors, including construction, transportation, energy, and water systems, resulting in an estimated 3–4% loss of global GDP annually. Traditional corrosion-resistant coatings often depend on synthetic polymers, heavy metals, and volatile organic compounds, which raise concerns about toxicity, non-biodegradability, and regulatory issues. Therefore, environmentally friendly alternatives that offer high corrosion protection are urgently needed. This study introduces a sustainable approach to developing green corrosion-inhibiting coatings using biochar-derived graphene oxide (GGO). Lignocellulosic wood waste was thermochemically converted into biochar at temperatures of 800–1000 °C and then processed into graphene oxide through an eco-friendly oxidation process. GGO was incorporated into a biodegradable coating matrix made of gum arabic and polyeugenol at loadings of 0.1–1.0 wt%. The coating performance was assessed with electrochemical impedance spectroscopy and potentiodynamic polarization in a 3.5 wt% NaCl solution. Preliminary results show that GGO-enhanced coatings achieved up to 85–92% corrosion inhibition efficiency, representing a 2–3 times increase in polarization resistance compared to the polymer-only control. Surface analysis indicated improved coating uniformity and fewer defects. These findings demonstrate the potential of biomass-derived graphene oxide as a high-performance, eco-friendly corrosion inhibitor that repurposes waste materials while reducing environmental and health risks associated with conventional coatings.

Title: Effects of Heat Loss due to Material Conductivity for Solid Fuel Burner

Primary Author: Vivian Wu

Additional Authors: Raheem Onifade;

Mentor: James Michael

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Solid fuel combustion portrays potential benefits to the design and performance analysis of hybrid propulsion systems. Polymers, such as polyoxymethylene (POM) and polyethylene (PE), are usable as a solid fuel for air-breathing rockets which possess advantages. Using solid fuel eliminates the storage of oxidizers in the rocket, since the solid fuel polymer can combust when reacting with oxygen from the atmosphere. These findings contribute to improved understanding of solid fuel combustion mechanisms and support regression rate correlations for solid fuel propulsion systems. This study investigates the burning behavior of polyethylene and POM solid fuels and analyzes the effects of thermal conductivity of the holder on regression rate. We measured regression rate, the measure of how quickly a fuel burns, with a stepper motor, and its displacement over time provided a measurement of the fuel regression rate. We directed a laser at the burning fuel surface and signaled adjustments to the stepper motor position to maintain position on the regressing surface. We conducted experiments using a counterflow burner with gaseous oxygen and nitrogen mix as the oxidizer. Flow conditions, such as percentage of oxygen and nitrogen mixed, were constant, and mass flow rates were varied. The thermal conductivity of the material around the polymer could affect the regression rate through heat transfer from the holder to the polymer. We expected a lower regression rate for a lower protrusion of the polymer from the surrounding material due to increased heat loss. The heat loss to the holder of the polymer may change due to the material of the holder; therefore, we changed the material of the holder from stainless steel to ceramic. Expected results include a decrease in regression rate as more energy is required to raise the polymer's temperature to its pyrolysis temperature. The goal of this study is to investigate the importance of understanding heat transfer to accurately evaluate the regression rate of polyoxymethylene and polyethylene.

Title: Biological Invasion Detection via Sentinel Gardens in Alabama

Primary Author: William Heaster

Additional Authors:

Mentor: Lori Eckhardt

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Infectious diseases of plants are an ongoing and increasing threat to international biosecurity, with a wide range of implications. These outbreaks in plant populations have devastating economic, environmental and societal consequences. Sentinel garden plantings in Alabama will function as attractants for invasive plants that could pose a threat to North American forests, acting as an early warning beacon which is essential to prevent widespread transmission. The monitoring of vegetation near major ports of commerce facilitates the early identification of forest pest and pathogens; however, the capacity to carry out this surveillance is often limited. Given that Alabama hosts a major port of entry and is situated near urban population centers, there exists a substantial opportunity to involve urban communities in bio-surveillance efforts, thereby enhancing the capacity for the early detection of emerging pests and pathogens. Sentinel plants present a proactive approach to biosecurity in a manner that promotes community involvement and education.

Title: Unleashed Impacts: A global synthesis of the effects of free-ranging dogs on wildlife

Primary Author: William Heintz

Additional Authors: Christopher Lepczyk; Patricia Hartman; Garrett Ake; Dani Thompson; Benjamin Harrell; Ally Cobern; Anna Digges;

Mentor: Jean Fantle-Lepczyk

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Invasive predators are a global threat to wildlife, due both to direct predation and competition for resources. Thus, they may serve as possible drivers of population decline. The diets of some predators, like free-ranging cats and foxes have been documented frequently in the past, resulting in significant concern for their ecological effects on wild populations. Despite free-ranging dogs' (*Canis familiaris*, *Canis familiaris dingo*) similar standing as an invasive domestic species, there has yet to be a thorough compilation and analysis of their effect on other species. Given that dogs depredate many of the same species as cats and are globally distributed, we hypothesize that free-ranging dogs are a major contributor to mortality of native species, via both depredation as well as trampling of individuals and nests, and as a result are environmentally as damaging as free-ranging cats. To test this hypothesis, we developed a comprehensive global assessment of species consumed by dogs, by reviewing scientific literature and reports spanning 1922 to 2025. To date we have identified 936 species eaten or killed by dogs, many of which are of conservation concern, from more than 65 countries. Species range from widely distributed livestock species to species which are endemic or of limited range. Our findings indicate that free-ranging dogs are consuming a very broad diet and may be as impactful as cats. These findings can be used to aid conservation efforts and identify management and policy actions to reduce their impacts.

Title: Evaluating Growth and Physiological Responses of Low-Lignin Poplar Under Variable Water Availability

Primary Author: William Latimer

Additional Authors: Chen Ding; Hao Chen;

Mentor: Chen Ding

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The increasing demand for sustainable fiber production has intensified the need for innovations that reduce environmental impacts while maintaining productivity. High lignin content in woody biomass increases the energy and chemical inputs required for pulping, presenting a major challenge for the forest products industry. This study evaluates the feasibility of integrating gene-edited low-lignin poplar varieties into agroforestry systems in the southern United States. A controlled greenhouse experiment was established using 105 poplar saplings consisting of one wild-type line and two low-lignin lines (15% and 18% lignin). Each line was subjected to three water treatments—well-watered, moderate water stress, and low water availability—with six replicates per treatment. Physiological performance was assessed using a LI6800 gas exchange system (LI-COR Biosciences Inc.) to measure photosynthetic rate across all treatments. Additional observations included growth performance and overall plant health to evaluate structural integrity and stress response. This study aims to quantify how reduced lignin content influences physiological resilience, growth, and adaptation under water-limited conditions, while also considering implications for carbon sequestration and economic viability. Preliminary greenhouse observations suggest that low-lignin poplars may increase fiber yield by up to 40% while reducing carbon emissions associated with pulping by approximately 20%. This research will provide critical data to researchers, landowners, and forest industry stakeholders, helping bridge the gap between laboratory innovation and large-scale deployment of climate-smart fiber production systems.

Title: Detecting Rice Transplanting Dates in Nigeria Using Sentinel-1 Time Series

Primary Author: Xintong Zou

Additional Authors:

Mentor: Zutao Yang

Department/Program: Solon Dixon Forestry Education Center

College: College of Forestry, Wildlife and Environment

Abstract: Differing from other crops, rice is typically transplanted into flooded fields to promote growth and suppress weeds. However, prolonged inundation makes rice fields a significant source of methane, with emissions strongly governed by flooding duration. Rice transplanting dates therefore represent an indispensable management factor determining both rice productivity and methane mitigation. Traditional approaches for acquiring transplanting date information rely on surveys or farmer interviews, which usually cover only a limited number of rice fields due to prohibitive costs, whereas remote sensing techniques provide opportunities to monitor cropland dynamics over broader spatial extents. In this study, Sentinel-1 SAR data, which are sensitive to rice phenological dynamics, were leveraged to detect rice transplanting dates in two Nigerian states, Kano and Jigawa during 2022-2023. We derived rice transplanting dates using three key SAR statistics, including the inflection point of VH, the maximum VH/VV ratio, and the minimum VH value. Compared with observed transplanting dates, the overall estimated dates achieved a Lin's Concordance Correlation Coefficient of 0.9274 and a mean absolute error (MAE) of 19.86 days, which is shorter than two Sentinel-1 revisit intervals of 12 days and sufficient for mapping regional phenological gradients. Seasonally, the MAEs for the wet and dry seasons were 19.32 and 20.32 days, respectively. These results demonstrate that SAR-derived features can effectively detect rice transplanting dates, thereby supporting agricultural management and improving predictions of rice productivity and methane emissions.

Title: Inhibition of AEP Suppresses Pathogenic Tau Cleavage and Phosphorylation in a Neuronal Stress Model

Primary Author: Yeongjae Kim

Additional Authors: Meenakshi Singh; Joyal Xavier;

Mentor: Rajesh Amin

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Alzheimer's disease (AD) is approaching epidemic levels and still lacks an effective disease-modifying therapy. Recent advances in clinically measurable biomarkers have improved the ability to evaluate emerging therapeutics. AD is characterized by the accumulation of hyperphosphorylated tau, which forms neurofibrillary tangles (NFTs), and amyloid- β plaques. The Amin Lab develops novel therapeutics targeting neurodegenerative processes, including compounds that inhibit asparagine endopeptidase (AEP), also known as legumain. AEP is a lysosomal cysteine protease that cleaves proteins at asparagine residues. Upon activation, AEP cleaves tau and contributes to downstream tau pathology. Prior studies have identified both tau and amyloid- β as physiological substrates of AEP, highlighting AEP as a promising therapeutic target in AD. In this study, we investigated the effects of Compound C, a novel AEP inhibitor developed in the Amin Lab, on AEP-mediated tau cleavage and phosphorylation. AEP activation was induced in HT22 neuronal cells using sodium arsenate (SA). Cells were treated with SA alone or with SA plus Compound C. Western blot analysis was used to quantify phospho-tau (~78 kDa) and total tau (~78 kDa) to determine whether Compound C selectively alters pathological tau species without affecting overall tau abundance. SA exposure produced a robust band at ~78 kDa consistent with stress-induced tau hyperphosphorylation. Co-treatment with Compound C significantly reduced phospho-tau levels compared with SA-only controls, while total tau expression remained unchanged. These findings suggest that Compound C suppresses the formation of pathogenic phosphorylated tau species rather than altering global tau levels. Compound C attenuates stress-induced phospho-tau accumulation in HT22 cells without affecting total tau, supporting its potential role in modulating tau pathology.

Title: When land got drier: Estimating the impacts of drought on farmland values in Alabama

Primary Author: Yingyun Lin

Additional Authors: Sunjae Won; Mykel Taylor;

Mentor: Mykel Taylor

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Drought is a major factor contributing to agricultural production losses in Alabama, bringing tremendous challenges to agricultural productivity and food security, but its impact on farmland value is still remains underexplored. This study investigates the influence of droughts on farmland value in the State of Alabama from 2007 to 2021. We combine a unique parcel-level farmland data set with drought information provided by United States Drought Monitor (USDM). Based on hedonic price method, we employ spatiotemporal fixed effect models as well as several robustness checks, finding longer periods of drought exposure can lead to farmland value reduction. We also reveal that the land value response to drought stress is heterogenous across different land use types. Our findings highlight the critical role for climate-resilient adaptation strategies in land use policies.

Title: Adult ESL learning in community: A case study of a “Community English” space

Primary Author: Yuan Zhang

Additional Authors:

Mentor: Jonathan Taylor

Department/Program: Educational FLT

College: College of Education

Abstract: Community-based English as a Second Language (ESL) programs, like those in churches and other community spaces, for example, have become essential learning spaces for adult English language learners seeking linguistic development, cultural integration, and social connection. Despite their growing importance, these volunteer-driven settings remain largely overlooked in educational psychology research and public discourse. This qualitative case study examines one such “Community English” program in Alabama, exploring how adult learners and volunteer instructors experience language learning in a flexible, culturally diverse, non-academic environment. Guided by sociocultural theory, the study integrates perspectives from educational psychology, adult learning, and language acquisition to conceptualize adult ESL learning as a social, experiential, and culturally mediated process. Drawing on interviews, observations, and program documents, the analysis highlights how learners navigate new linguistic and cultural landscapes while negotiating identity, belonging, and cross-cultural relationships. The study also examines how volunteer instructors adapt instruction, build relationships, and respond to the challenges and opportunities inherent in a community-embedded, non-formal learning space. “Community English” is conceptualized as a distinct educational context with dual significance: it is both a site of language learning and a site of meaningful community participation. Findings highlight how learning unfolds through relationships, meaningful activity, and participation in supportive sociocultural contexts.

Title: Configuration Defects in Kubernetes

Primary Author: Yue Zhang

Additional Authors: Akond Ashfaq Ur Rahman;

Mentor: Akond Ashfaq Ur Rahman

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Kubernetes is a tool that facilitates rapid deployment of software. Unfortunately, configuring Kubernetes is prone to errors. Configuration defects are not uncommon and can result in serious consequences. This paper reports an empirical study of configuration defects in Kubernetes with the goal of helping practitioners detect and prevent these defects. We study 719 defects extracted from 2,260 Kubernetes configuration scripts obtained from open-source repositories. Using qualitative analysis, we identify 15 categories of defects, of which seven have not been reported in previously-studied software systems. We find eight publicly available static analysis tools to be capable of detecting 8 of the 15 defect categories. We find that the highest precision and recall are achieved for defects related to data fields. We develop a linter to detect two categories of defects that cause serious consequences and that none of the studied tools are able to detect. Our linter revealed 26 previously unknown defects that have been confirmed by practitioners, 19 of which have already been fixed. We conclude our paper by providing recommendations on how defect detection and repair techniques can be applied to Kubernetes configuration scripts. The datasets and source code used for the paper are publicly available online.

Title: EMG-Based Lower Limb Motion Prediction Using Machine Learning

Primary Author: Yusuf Arik

Additional Authors: Sierra Eady;Ivan Nail Ulloa;Michael Zabala;

Mentor: Michael Zabala

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Surface electromyography (EMG) is a noninvasive technique used to record muscle activity during movement and is widely applied in rehabilitation and wearable assistive technologies. Despite advances in sensing hardware, EMG signals remain noisy and highly variable due to factors such as electrode placement, muscle fatigue, and subject differences. This variability complicates accurate motion prediction, particularly in real-time applications, and emphasizes the need for reliable muscle activation detection methods. This study evaluated EMG preprocessing and muscle activation detection techniques for lower limb motion prediction during walking. The left gluteus maximus was selected as the target muscle because of its important role in hip extension and abduction during the gait cycle. Existing laboratory EMG datasets collected during walking tasks were processed using zero centering, rectification, and normalization to improve signal quality and reduce variability. Furthermore, muscle activation was identified using a threshold-based approach, with thresholds defined as two or three standard deviations above baseline activity and calculated separately for each trial. This method accounted for trial specific variability while maintaining consistent activation criteria. The processed EMG signals and corresponding activation labels were then used to train machine learning models, including Long Short-Term Memory neural networks and Multilayer Perceptron models. Model performance was evaluated using classification accuracy and computational runtime to assess suitability for near real-time use. In this study, the proposed EMG preprocessing, muscle activation detection, and machine learning framework is intended to support EMG-based motion analysis and prediction during walking. The outcomes of this study can be used to inform the design of EMG-driven control strategies for future rehabilitation and wearable assistive system applications.

Title: Multi-DOF haptic device for assessment of movement disorders using archimedes spirals

Primary Author: Zachary Miller

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Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Involuntary tremors are often characterized by an unwanted, chaotic, rhythmic motion that can vary in severity as well as location. One of the most common causes of tremor is movement disorders resulting from neurological impairment, such as Essential Tremor (ET), Parkinson's Disease (PD), dyskinesia, etc. These involuntary movements can negatively impact a person's quality of daily life by impairing things like drinking, eating, speaking, writing, and even walking in some of the most severe cases. As a result, neurologists have developed rating scales for clinicians, that would allow a clinic to rate the severity of an impaired individual's tremor, allowing for a better understanding of how to help said patient. Some of the characteristics and causes of these tremor vary by the underlying disease, leading to multiple severity scales being developed, such as the Fahn-Tolosa-Marin Clinical Rating Scale for Tremor (FTM) and the Essential Tremor Rating Assessment Scale (TETRAS) for ET, and the Unified Parkinson's Disease Rating Scale (UPDRS) for PD. One thing these scales have in common is the use of handwriting and the drawing of an Archimedes Spiral to aid in diagnosing tremor severity in the hands. However, the writing and drawing portion of these assessments often relies on the clinician assessing the tremor severity based on subjective metrics outlined in the official scales. Additionally, these assessments are done by drawing on a table, allowing for the participant being assessed to steady their hand by pressing down on the table as it provides an infinite stiffness. The aim of this study is to use the 3D Systems Haptic Touch, a Multi-DOF Haptic device, to allow for the assessment to be unconstrained in the z-axis by using a finite stiffness haptic floor, which would allow for deviations in height that are not possible on an infinite stiffness 2D plane like the table.

Title: Intelligent Monitoring of Pavement Deformation at NCAT Using PS-InSAR with Corner Reflector Calibration and Validation

Primary Author: Zahra Ghorbani

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Abstract: Monitoring millimeter-scale deformation of highway infrastructure remains challenging due to the localized nature of pavement distress and limitations of traditional ground-based sensing. This study presents a satellite-based intelligent monitoring framework for assessing surface deformation at the National Center for Asphalt Technology (NCAT) test facility in Auburn, Alabama, using Sentinel-1 Persistent Scatterer Interferometric Synthetic Aperture Radar (PS-InSAR) and corner reflector validation. To support calibration and visibility testing, a corner reflector was installed near the NCAT test track in early December 2025 to verify satellite detection capability and optimize deployment methodology. Sentinel-1 SAR amplitude imagery confirms successful detection of the reflector with a clear high-amplitude response and normalized backscatter intensity exceeding 0.8, validating the installation approach for future operational sites. Building on this validation, a comprehensive PS-InSAR analysis was conducted using PyGMTSAR spanning February 2017 to January 2026, providing over eight years of continuous displacement monitoring at this controlled infrastructure site. Mean line-of-sight velocity maps reveal deformation rates ranging from -18 to $+18$ mm/yr across the facility, with most areas stable within ± 5 mm/yr. Time series analysis demonstrates that stable reference zones including the corner reflector location remain within ± 10 mm over the observation period, while localized subsiding zones show cumulative displacements of -60 to -110 mm. To provide environmental context for observed deformation behavior, auxiliary datasets including precipitation, soil moisture, and vegetation indices were integrated into the analysis. Low vegetation density across the NCAT facility contributes to high interferometric coherence, enabling reliable pavement-scale deformation detection even for small-magnitude movements. Observed displacement patterns show qualitative consistency with seasonal environmental fluctuations, supporting physical interpretation of infrastructure response to environmental loading. This study demonstrates the feasibility and reliability of PS-InSAR for infrastructure-scale deformation monitoring under controlled conditions, establishing a validated baseline for future operational highway monitoring applications and integration with traffic and environmental data streams.

Title: Effect of polymer side chains on ultrafast dynamics of electrochemically induced polarons

Primary Author: Zainab Adeoluwa

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College: College of Sciences and Mathematics

Abstract: Conjugated polymers (CPs) are widely studied for use in modern organic electronic devices due to their tunable conductive properties. They exhibit electrical and optical properties owing to their conjugated backbone, which allows the transport of charges. CPs' charge transport can be fine-tuned by electrochemical doping (oxidation or reduction), which creates a mobile charge carrier known as a polaron that hops through the backbone of the polymer. Structural engineering is used to enhance the effectiveness of charge transfer in CPs, which relies on controlling various interactions, including molecular ordering, electronic delocalization, and ionic-electronic coupling. While several studies have explored the impact of side chains on crystallinity and conductivity properties through various spectroscopic techniques, the specific role of side chain engineering in optimizing these properties is yet to be understood. In this study, we are studying the effect of including an extra methyl group in the side chain of a model polythiophene system (P3MEEET and P3MEEMT) by using transient absorption-spectroelectrochemistry. We observed polaronic features in the near-infrared spectrum upon electrochemical oxidation of both polymers. However, at low bias only P3MEEET formed ion-free polarons, suggesting that its more ordered structure (due to its larger side chain) enhances polaron mobility by preventing ion-trapping. At higher bias, ion-bound polarons are primarily formed in the disordered phase in both polymers, where the ions can electrostatically trap polarons. These findings suggest that polymer structure can be exploited to increase the amount of ion-free polarons to improve conductivity at low bias, which could improve their performance in electrochemical devices.

Title: Engineering superparamagnetic iron oxide nanoparticles (SPIONs) for contrast-enhanced MRI

Primary Author: Zainab Omodunni Olomowewe

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College: Samuel Ginn College of Engineering

Abstract: Superparamagnetic iron oxide nanoparticles (SPIONs) have emerged as promising Magnetic resonance imaging (MRI) contrast agents owing to their high magnetic susceptibility, intrinsic biocompatibility, and biodegradability. Despite these advantages, conventional SPIONs predominantly act as T_2 contrast agents, producing negative (dark) contrast that can obscure anatomical details and complicate the distinction between healthy and diseased tissues. Therefore, developing ultras-small SPIONs (≤ 10 nm) with tunable surface or environmental modifications that promote T_1 -weighted contrast behavior offers a safer and more diagnostically effective alternative to conventional agents. In this study, we investigate the contrast property of Polyethylene glycol modified SPIONs (PEG-SPIONs). By tuning SPION core size and surface coating thickness, we evaluate their influence on the longitudinal (T_1) and transverse (T_2) relaxation times of surrounding water protons. SPIONs were synthesized via a controlled co-precipitation method and stabilized with poly (acrylic acid) (PAA) to prevent aggregation. Nanoparticle characterization was performed using Dynamic light scattering (DLS), Thermogravimetric analysis (TGA), X-ray Diffraction (XRD), and Vibrating sample magnetometer (VSM) to determine physiochemical and magnetic properties of bare and PEG-modified particles. Preliminary results indicate that the synthesized SPIONs are of small and uniform sizes, exhibiting colloidal stability, and superparamagnetic behavior suitable for biomedical applications. Ongoing work focuses on evaluating how these relevant surface parameters affect the relaxometry behavior of SPIONs, to develop a controllable strategy to fine-tune their contrast property.

Title: Electrode improvement for the catalyzed production of green hydrogen

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College: Samuel Ginn College of Engineering

Abstract: As the world begins to shift its energy focus towards low emission sources, hydrogen emerges as a contender to replace fossil fuels such as natural gas. The problem with hydrogen is that it tends to be expensive to produce without reforming natural gas, a process that releases carbon emissions in the same way as burning the natural gas. Hydrogen is normally produced through pumping electrical current through water to electrolyze it. Catalytic electrodes, which are usually made of platinum, are used to reduce the electricity needed to perform this process. Alternative electrodes were tested by 3D printing copper infused filaments to produce electrodes with geometry intended to maximize surface contact with water in order to produce hydrogen approaching the efficiency of platinum at a fraction of the cost. The electrode sizes tested were 1" by 2" by 1.5mm and the solution used was 1M sulfuric acid in water. Additionally, electroplating the print with copper or nickel metals will be tested to improve the electrode's efficiency. The results confirmed that 3D printed electrodes were capable of electrolyzing water into hydrogen gas without being electroplated, but not achieve the expected efficiency. The copper electroplated electrodes, however, were able to produce at a more efficient scale, probably due to the stability and high conductivity in sulfuric acid. But further testing is needed to fully determine the capacity. The nickel plated electrodes have not been tested thus far, but it is planned to be a viable alternative if the copper electrodes have issues with corrosion. Although further testing is needed, the results confirm that it is possible to produce electrodes capable of electrolyzing water at a fraction of the cost of platinum electrodes. Decreasing the cost of these electrodes would make hydrogen a more viable alternative to natural gas.

Title: Fluorescence-based sensor for detection of sulfur-containing volatile compounds in poultry environments

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Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The current industrial production of poultry with high animal density releases hazardous greenhouse gases, hydrogen sulfide, dimethyl disulfide (DMDS), and volatile organic compounds that produces unpleasant odors and pose risks to both animals and worker health. Long-term exposure to these volatile sulfur compounds (VSCs) is related to respiratory and chronic health effects and also suggest spoilage or microbial activity. Sensor-based detection methods provide a possible alternative by using the strong interactions between DMDS and chemically responsive materials, producing measurable optical signals. Fluorescence-based sensors, especially porphyrins, metalloporphyrin, and anthocyanins, are successful due to their tunable electronic structures and sensitivity to sulfur compounds. However, these sensors often confront issues such as cross-sensitivity, external interference, signal drift, and material instability. For example, Porphyrin-based sensors may suffer from irreversible binding or signal saturation during long-term exposure to sulfur compounds, whereas anthocyanins are prone to deterioration, photobleaching, and unstable under pH alteration, temperature, and light conditions. These limitations require the use of multi-array sensor designs and advanced data analysis techniques to improve discrimination and practical application. In this work, we propose a fluorescence-based multi-array sensor technology for the selective detection of disulfide compounds and other sulfur-containing VOCs associated with poultry odor. To initiate the process, chlorophyll was extracted from chlorella powder and purified via column chromatography to enrich target volatile fractions prior to analysis. To record distinctive emission patterns, a multi-array fluorescent sensor system will be created later. The work is still on progress. Preliminary studies demonstrate unique fluorescence responses of pure chlorophyll. The goal of this ongoing project is to close the gap between laboratory-based VOCs analysis and portable sensing devices. Future work will focus on structural analysis with NMR, enhancing sensor specificity, validation against GC-MS, and real-time environmental monitoring.

Title: Energy-Oriented Multi-Dimensional Resource Service for Air–Ground Cooperative WPMEC Network

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Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Wireless powered mobile edge computing (WP-MEC) systems enable sustainable energy support for terminal devices (TDs) in resource-constrained environments, which can ensure reliable task execution across various application scenarios. However, most existing studies treat caching, task offloading, and communication separately. This ignores the connections between them, which limits the overall performance of the system. To address these challenges, we propose a joint optimization framework for cooperative scheduling of the unmanned aerial vehicle (UAV) and the base station (BS) to minimize the system energy consumption. We design an internal and external co-optimization algorithm (IECA) that decomposes the original complex problem into two subproblems: an external caching optimization and an internal resource allocation optimization. Specifically, the external problem uses deep reinforcement learning (DRL) to determine the UAV caching strategy, while the internal problem adopts a block coordinate descent (BCD) method to iteratively optimize the wireless energy allocation, task offloading ratios, and transmission power. In each iteration, the internal problem solver alternates among three convexified subproblems to efficiently ensure convergence. Meanwhile, UAV caching decisions significantly affect the feasibility and structure of inner-layer constraints. This interaction requires coordinated optimization between the two layers to achieve overall performance gains. Simulation results validate that the proposed method substantially reduces the overall system energy consumption compared to conventional baselines, while also improving task service efficiency and system robustness.

Title: Moderators of the bidirectional spillover between marital conflict and coparenting quality in preadolescence

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Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Marital conflict and coparenting quality are often negatively associated. However, few studies have investigated how these constructs are bidirectionally related or which conditions exacerbate spillover between them. Utilizing random-intercept cross-lagged panel models, the current study examined whether child adjustment, positive parenting, and financial hardship moderate associations between marital conflict and coparenting quality among families with preadolescents through three waves, with one year intervals. Participants were 122 couples (child Mage = 9.4 years at T1, 54% boys, 79% European American, 21% African American). Mothers and fathers reported on marital conflict, coparenting quality, and positive parenting, and mothers reported on child adjustment and financial well-being. At the between-family level, couples who reported higher marital conflict also reported lower coparenting quality. At the within-family level, at higher levels of externalizing and internalizing problems and at lower levels of financial well-being, coparenting quality at T1 was negatively associated with marital conflict at T2, whereas marital conflict at T2 was positively associated with coparenting quality at T3. These findings suggest that similar vulnerability factors may trigger a spillover process from lower coparenting quality to higher marital conflict, but a compensation process from higher marital conflict to higher coparenting quality. This study highlights the importance of considering the bidirectional nature of the associations between marital conflict and coparenting quality both within and between families.

Title: Harnessing the power of plant-associated microbiomes to confer temperature stress resilience in tomato

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Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Rising global demand for stable food systems has been increasingly challenged by unprecedented crop loss driven by rapid environmental change. As these pressures intensify, innovations in plant health are becoming an urgent priority for global food security. In addition to advances in crop breeding and controlled environment agriculture (CEA), the plant microbiome is a promising approach for enhancing plant resilience under changing conditions. The plant-associated microbiome functions as an extended layer of host immunity by contributing to increased tolerance of biotic and abiotic stressors and improvement of plant nutrient acquisition. However, the processes driving plant microbiome assembly and persistence under novel abiotic stress remain poorly understood. In this study, supported by USDA-NIFA's Green Reimagining of Agriculture in Controlled Environments (GRACE) project, we aim to investigate microbiome community dynamics associated with temperature stress resilience in tomato. Bacterial isolates from several tomato genotypes across diverse geographical conditions were assembled into unique microbial consortia and inoculated onto tomato seeds, followed by plant physiological growth measurements and whole-genome sequencing analyses of individual isolates included in the inoculum. Results from this work outline unique shifts in the abundance of key microbial community members and have led to an increased understanding of how microbiome assembly patterns in tomato are responding to temperature stress and impacting plant growth. Continued analysis of this work will provide a framework for developing optimized microbial inoculations to improve tomato performance under rapidly intensifying environmental conditions.