Auburn University Research Symposium 2025

Wednesday, March 26, 2025

Harold D. Melton Student Center

This booklet includes the abstracts of the presentations.

The abstracts are ordered by the first name of the submitting author.

Title: The effects of different soybean meal sources on the growth performance of Pacific White shrimp Litopenaeus vannamei reared in the clearwater system

Primary Author: Aakriti Khanal

Additional Authors: Allen Davis;Timothy Bruce;Khanh Quoc Nguyen;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Soybean meal (SBM) is one of the essential plant-protein sources in aquaculture feed. Several methods have been used to reduce oligosaccharides and other antinutrients to improve the quality of the SBM. In this work, we used low oligosaccharide (LO-SBM) and enzyme-treated soybean (ET-SBM) meals as the primary protein source; this study sought to assess the effects of varying replacement percentages of SBM with LO-SBM or ET-SBM on the growth and feed utilization efficiency of Pacific white shrimp. Nine isonitrogenous (35% protein) and isolipidic (8% lipid) diets were formulated. The basal diet utilized solvent-extracted soybean meal as the primary protein source (49% of the total diet) and was incrementally replaced (40%, 60%, 80%, and 100%) using LO-SBM or ET-SBM. Fifteen juvenile L. vannamei were stocked in each of the 44 indoor recirculating aquaculture system tanks. Diets were randomly assigned to five replicate tanks. The experiment was performed for five weeks, during which the shrimp were fed four times throughout the day, and the feed ration was adjusted weekly. At termination, shrimp were counted, and the group was weighed to assess survival, growth, and FCR. Subsequently, two shrimp guts were collected per tank of the basal, LO-SBM100%, and ET-SBM-100% treatments. The remaining shrimp from each tank were preserved and later analyzed for whole-body proximate composition. All growth metrics in the trial showed better performance or shrimp feed LO-SBM diets ($p<0.05$). Except for phosphorus retention ($p<0.001$), we observed no significant differences in whole-body proximate composition ($p>0.05$). The outcome showed the potential of replacing the solvent-extracted soybean meal with a new variety of low oligosaccharide and enzyme-treated meals when needed, as well as survival or feed conversion ratio (FCR). Additional results on gut microbiomes will be presented. Low oligosaccharides and enzyme-treated SBM supported good shrimp growth and are suitable protein sources.

Title: Health Literacy: An observational cross-sectional survey at an Alabama community health center

Primary Author: Aaron Bohn

Additional Authors:

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Healthcare professionals in the U.S. often use health education materials to compliment their service of care. This method can be useful to improve patients' health outcomes. However, in rural areas, this could prove less effective due to a lower health literacy level. In this study, we will analyze the reading level of the health education materials given out at a rural Alabama community health center using the Flesch-Kincaid grade level score. In conjunction, we will administer the Rapid Estimate of Adult Literacy in Medicine - Short Form (REALM-SF) and a brief survey on health literacy perceptions to the patients at this site. These measures will allow a quantitative analysis of the data, which may make for easier replication of the study in the future. Currently, the study is being prepared for administration. We anticipate that the reading level of the materials will be higher than what is appropriate for this patient population. Our goal is to identify any potential disparities in the data, which could prompt further research or interventions aimed at improving health outcomes and quality of life in rural areas.

Title: Natural variations in soybean vein necrosis virus movement protein (NSm) enable expression and delay cell death in plants

Primary Author: Abdelaal Hamaam Abdelaal Shehata

Additional Authors: Edward Sikora;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Soybean (Glycine max L.) is a popular crop among many farmers in Alabama due to the state's warm growing climate, which contributes to its production value of $195.8 million in 2023. In plants, soybean vein necrosis virus (Orthotospovirus glycininecrovenae, SVNV) causes symptoms of necrosis that appear as patches of dead cells between the veins of infected leaves, ranging in color from brown to dark. SVNV is an ambisense, single-stranded RNA virus transmitted by the primary vector Neohydatothrips variabilis in a persistent, propagative manner. It has three genomic segments that encode six open reading frames (ORFs), including NSs (putative non-structural silencing suppressor), N (nucleocapsid), NSm (putative non-structural movement), GN and GC (glycoproteins), and L (RNA-dependent RNA polymerase). In this study, NSm of SVNV was selected to understand the cause of the necrotic symptoms linked to this virus. The original sequence of NSm isolated 15 years ago from Tennessee (accession: GCF_004789395.1), and a representative sequence from Alabama isolated in 2023 (accession: PP855220.1) were compared. The two sequences were cloned into a pSITE-2CA vector to allow for fusion to Green Fluorescent Protein (GFP). A host for this virus, Nicotiana benthamiana, was infiltrated with NSm:GFP, and images were captured for a time course assay from two to four days post infiltration (dpi) using confocal microscopy. These images revealed that NSm from TN does not express and leads to cell death as early as four dpi. In contrast, NSm from AL exhibited protein expression and did not induce cell death until four dpi. This was confirmed using a cell death stain, SYTOX blue. These findings highlight the evolution of SVNV NSm over a 15-year period and will enhance our understanding of SVNV infection and potential new management strategies.

Title: Investigating the impact of pore heterogeneity on porosity-permeability evolution in the lower Tuscaloosa formation

Primary Author: Abdullah Al Nahian

Additional Authors: Nora Rivera;Lauren Beckingham;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Understanding the pore structural heterogeneity of subsurface formations is essential for evaluating reservoir properties and predicting the effects of CO_2 injection on formation characteristics during carbon sequestration. This study investigates the Lower Tuscaloosa formation, a deep saline reservoir, to evaluate the role of pore heterogeneity in porosity-permeability evolution and geochemical reactions. Fifteen core samples were collected from a single drill core at depths ranging from approximately 7,700 to 8,400 feet. Detailed analyses, including X-ray diffraction (XRD) and 3D X-ray micro-computed tomography (micro-CT), were performed to characterize the mineralogical composition and pore structure of these samples. XRD analysis identified silicate minerals as the predominant components of the cores, with Quartz and Feldspar being the dominant phases. These cores were subjected to high-resolution 3D micro-CT imaging to examine pore structural heterogeneity. The imaging, conducted at a resolution of 2.5 microns, provided detailed pore-scale insights. These images were processed and analyzed using ImageJ and MATLAB to quantify pore geometry, connectivity, and heterogeneity. The study aims to simulate porosity-permeability evolution under varying pore structural characteristics and assess the impact of heterogeneity. Comparative analyses will be conducted using simulation results derived from heterogeneous data models and averaged data models to evaluate the influence of pore-scale heterogeneity on reservoir behavior. This comparison will also determine whether simplified models adequately represent the complex interactions occurring in heterogeneous formations. This research will comprehensively explain how pore-scale heterogeneity influences reservoir properties during CO_2 sequestration. By integrating advanced imaging techniques with pore-scale modeling, this study will provide valuable insights into optimizing reservoir management strategies and improving the accuracy of CO_2 storage efficiency predictions.

Title: Understanding the implications of methodological variations on digestibility estimates from in vitro ruminal fermentation assays

Primary Author: Abigail Boggier

Additional Authors: Abbigail Hines;Diva Rigney;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: In vitro ruminal fermentation assays are pivotal for evaluating feed efficiency and animal productivity. However, inconsistencies in modern methodologies can compromise the reliability of digestibility estimates. This study investigates the impact of methodological variations, including buffer types, cheesecloth layer filtration, and homogenization techniques on in vitro dry matter digestibility (IVDMD) outcomes to identify sources of variability and inform assay standardization for Tilley and Terry (1963) and Goering Van Soest (1970) methods. Measurements included: dry matter, organic matter, and IVDMD estimations. Protocol I evaluated if differences in IVDMD estimates are a factor of the buffer solutions employed using a 2 x 2 x 4 factorial treatment structure with two steers, two buffer types, and four bermudagrass cultivars. Protocol II sought clarification from the lack of statistical difference observed in the first experiment. This protocol further investigated specific methodological factors influencing IVDMD. A complete randomized block design was used, evaluating homogenization (YES, NO) and cheesecloth layering (2, 4, 6, 8, 10, or 12) utilizing Coastal bermudagrass (Cynodon dactylon) and 2000 mL of composited ruminal fluid from two cannulated steers. In Protocol I, the IVDMD results were greater for the Tilley-Terry buffer treatments (39.0%) compared to the Goering-Van Soest buffer treatments (31.9%). Additionally, for samples processed without buffers, the Goering-Van Soest method yielded higher IVDMD values (39.5%) compared to the Tilley-Terry method (33.0%). This differentiation clarifies that buffer type and method independently influence IVDMD outcomes. In Protocol II, the IVDMD results demonstrated higher mean values for the Goering-Van Soest method (49.8%) compared to the Tilley-Terry method (39.7%). Homogenized samples had a slightly greater mean IVDMD (46.0%) compared to non-homogenized samples (43.4%). Cheesecloth layers 4 and 8 had the highest digestibility values at 47.6% to 48.7%, respectively. Collectively, these results highlight that methodological variations do influence in vitro digestibility estimates, underscoring the need for assay standardization.

Title: Estimation of Logging Equipment's Carbon Emission in the Southeastern US.

Primary Author: Abubakar Tahiru

Additional Authors:

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Mechanized whole-tree (WT) harvesting is the dominant logging method in the Southeastern United States, yet its carbon emissions remain insufficiently quantified. This study evaluates CO_2 emissions from logging equipment under real-world operational conditions using Portable Emission Measurement Systems (PEMS). Emissions were analyzed based on Diesel Exhaust Fluid (DEF) usage, machine type, engine power, and activity type. Results indicate that DEF-equipped machines emitted 46.18 g/kWh less CO_2 on average compared to non-DEF machines ($p < 0.001$). Among machine types, feller bunchers had the highest CO_2 emissions, while loaders emitted 176 g/kWh less CO_2 than feller bunchers. Higher engine power levels were associated with lower emissions, with machines in the 185kW-205kW category emitting 100.75 g/kWh less CO_2 than those in the 125kW-164kW group. Activity type also played a significant role, with idling producing the lowest CO_2 emissions, while "loaded" skidding exhibited the highest levels. These findings highlight the influence of DEF technology, machine type, and operational factors on emissions, providing valuable insights for optimizing mechanized harvesting practices to reduce carbon emissions while maintaining operational efficiency.

Title: Speech sound errors and language ability are predictive of word reading and spelling

Primary Author: Addison Garrott

Additional Authors: Anna Ehrhorn;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: The production of speech sound errors (SSE) puts children at risk for word reading and spelling difficulties. While SSE may be indicative of a speech production deficit, there are many children who do not present with a clinical deficit but later have word reading and spelling difficulties. Additionally, language ability is a strong predictor of word reading and spelling. Measurement of SSE and language ability may better predict risk for word reading and spelling difficulties. The present study examined SSE to predict word reading and spelling in children with varying speech abilities while accounting for language ability. Standardized speech, language, wording reading, and spelling assessments were examined from sixty 6–8-year-old children. Productions from two speech sound assessments were scored for frequency and characterization of errors. The frequency of errors was converted to proportion of errors with each error being characterized as a sound addition, substitution, or omission. Linear regression results suggested that a smaller proportion of SSE predicted stronger word reading and spelling. Better word reading and spelling occurred when less sound substitutions and omissions were present. Language ability consistently strengthened these results. School professionals should consider providing more word reading and spelling instructional support for children who produce a greater number of SSE where sounds are often being substituted, especially for children who present with a language deficit.

Title: Examining Urinary Volatile Organic Compound Disparities in Childhood Obesity

Primary Author: Adebowale Samuel Oyerinde

Additional Authors: Geetha Thangiah;Ramesh Jeganathan;Melissa Boersma;JackQuoia Baulding;Mallory Gibson;Jeremy Carson;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Childhood obesity has increased globally, posing long-term health risks, yet its metabolic mechanisms remain unclear. Urinary volatile organic compounds (VOCs) offer a promising approach for identifying obesity-related biomarkers, as they reflect physiological and pathological changes. While VOCs in breath have been studied, research on urinary VOCs is limited. Furthermore, many studies overlook key confounders like racial and socioeconomic disparities, which are closely associated with childhood obesity prevalence. This study aimed to evaluate the urinary VOCs profile in normal-weight versus overweight/obese children and identify VOCs that predict obesity outcomes. A total of 159 children, including 98 normal-weight and 61 overweight/obese and participants, were enrolled in this cross-sectional study. Normal weight and overweight/obesity and were classified based on body mass index z-scores. Urine samples were analyzed using solid-phase micro-extraction gas chromatography-mass spectrometry under glucuronidase and sulfatase conditions to capture a broad spectrum of urinary volatiles with diverse physicochemical properties. Multiple linear regression was conducted to examine the association between urinary VOCs and obesity, assess the influence of race and socioeconomic status (SES), identify case clusters, and determine VOCs that differentiate normal weight from those overweight/obese children. A total of 67 VOCs were identified under enzyme-treated conditions, distinguishing normal-weight from their overweight/obese children's counterparts. Among these, 11 VOCs remained significant predictors of obesity even after adjusting for racial and SES disparities ($p < 0.01$). However, VOCs, hexanal, 4-heptanone, 2-pentylfuran, 4'-(2-methylpropyl) acetophenone, 6-methyl-5-hepten-2-ol, geraniol, and gamma-dodecalactone demonstrated strong predictive potential. These VOCs exhibited receiver operating characteristic (ROC) area under the curve (AUC) values ranging from 0.503 to 0.737, with sensitivity and specificity exceeding 0.6, indicating their potential as biomarkers for obesity. This study demonstrates that VOC signatures differ significantly between normal-weight and overweight/obese children, highlighting their potential diagnostic and predictive value for obesity outcomes. Notably, racial and socioeconomic disparities appear to have little to no effect as confounding variables in childhood obesity.

Title: Secure and privacy-preserving word embedding evaluation via zero-knowledge proof protocols

Primary Author: Aditya Singh

Additional Authors: Dr. Robert Underwood; Dr. Olcay Kursun;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Words are more than just letters put together—they have meanings and relationships with other words. In language technology, we can represent words as points in a mathematical space, where similar words are placed closer together. These word embeddings help computers understand human language. However, testing whether these embeddings are good usually requires access to the data and models used to create them, which can be a privacy risk. To solve this problem, we introduce a new way to test word embeddings without exposing sensitive data. We use a zero-knowledge proof (ZKP), a special technique that allows someone to verify information without actually seeing it. In our system, one person (Victor) wants to check the quality of word embeddings provided by another person (Peggy). Instead of sharing raw data, Victor picks important words using a text analysis method and sends them to Peggy. Peggy then applies the embeddings, hides them using ZKP, and sends them back. To ensure that the hidden embeddings still keep their relationships, Peggy uses a mathematical transformation that preserves the meaning of words. Finally, Victor evaluates the quality using a machine learning model. This method allows researchers and companies to test word embeddings without risking data security. It can be useful in areas like healthcare, finance, and businesses that want to protect their language models while still ensuring their quality.

Title: Prenatal cannabinoid exposure: Effects on anxiety through trace-fear conditioning behavior assessment

Primary Author: Victoria M. Petty

Additional Authors: Adrian Courville; Miranda Reed;Vishnu Suppiramaniam;Emma Redmon;Miles Wiley;Kawsar Chowdhury;Iva Durdanovic;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: While many believe that cannabis use during pregnancy poses no risk, human epidemiological and animal studies indicate that prenatal cannabinoid exposure (PCE) can lead to long-lasting changes in cognitive and emotional processes. This study aims to investigate the effects of PCE on anxiety-like behaviors using a trace-fear conditioning paradigm, a hippocampus-dependent associative learning task, followed by fear extinction, which depends on the medial prefrontal cortex (mPFC). In trace fear conditioning, rats are presented with a tone (neutral stimulus) followed by a 1-second foot shock (aversive stimulus), separated by a trace interval, a stimulus-free period that requires hippocampal and mPFC involvement for memory formation. After a 240-second inter-trial interval (ITI), the procedure is repeated multiple times. Primary dependent measures include freezing during baseline (to assess general activity levels) and freezing during the trace interval (to evaluate fear expression). On day 2, contextual fear memory retention is tested by placing the animals back into the original training chamber for five minutes with no stimuli, measuring freezing as an index of memory recall. Next, animals are placed in a novel context for extinction training, consisting of 40 trials where the tone is presented without shock. Freezing behavior during the first eight trials is analyzed to assess retention of the tone-shock association. On day 3, an extinction retention test is conducted, consisting of eight tone presentations after a one-minute baseline period to assess how well fear extinction is maintained over time. We hypothesize that PCE will impair trace-fear extinction, leading to heightened anxiety-like behavior, indicated by increased freezing responses during extinction trials. This effect may result from disrupted hippocampal-prefrontal connectivity, altering the neural circuits responsible for associative learning and fear regulation. These findings will contribute to a deeper understanding of how prenatal cannabis exposure affects long-term hippocampal function, learning, and anxiety-related behaviors.

Title: Dysregulated Lysosome Biogenesis and Abnormal Lysosomal Activity Potentially Drive Human Alcohol-Associated Liver Disease

Primary Author: Ahmed Bakheet

Additional Authors: Murugadas Anbazhagan;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Background: Lysosomes are critical for degrading cellular macromolecules, thereby maintaining cellular homeostasis. In rodents fed ethanol, lysosomes are downregulated, leading to accumulation of undegraded polymeric substrates. However, the connection between these changes in human alcohol-associated liver disease (ALD) is not fully understood. Here, we investigated lysosomal alterations in livers of human subjects with alcohol-induced hepatitis (AH) and cirrhosis (AC) to assess the role of lysosomes in ALD pathology. Methods: Livers of normal human subjects or those with AH or AC were subjected to immunostaining, RT-PCR, and Western blot (WB) analyses. Results: Compared with normal livers, mRNA levels encoding Transcription Factor EB (TFEB), which regulates autophagy and lysosome biogenesis, were elevated 4.5-fold in livers with AH and by 2.5-fold in those with AC. The upregulation of TFEB mRNA was associated with increased expression of two of its targets, PGC1α and VAT6V1H (acidifies lysosomes). In AH livers, mRNAs encoding the lysosomal-associated membrane proteins LAMP1 and LAMP2 were unchanged. However, in AC livers, both LAMP1 and LAMP2A mRNA levels were elevated, compared with normal livers. WB analyses of AH and AC liver homogenates revealed significantly higher levels of TFEB, the lysosomal protease cathepsin B (Cat B), and the lysosome damage-sensing protein Galectin-3 (Gal-3). Compared with normal livers, LAMP1 levels were lower in AH livers but were higher in AC livers. Immunostaining showed enhanced TFEB expression in both the cytoplasm and nuclei of hepatocytes of AH livers. Additionally, Cat B, Gal-3, and the autophagosome marker LC3B, showed increased staining in hepatocytes of AH livers compared with normal livers. In normal livers, LAMP1/2 and Cat B appeared as small, punctate structures, whereas in AH livers, they were larger and aggregated. In AH livers, Cat B was widely distributed throughout the entire hepatocyte, and it exhibited enhanced interaction with lipid droplet (LD) membranes. Gal-3, LC3B, and P62 were also associated with LD membranes. High colocalization of cat B and LAMP2 with Gal-3 was observed in AH livers. Conclusion: Our findings suggest that in human ALD, there is enhanced lysosome biogenesis, and this could be a response to increased processing of substrates like lipids. This may lead to lysosomal substrate accumulation, damage, and leakage, leading to hepatocyte injury, thereby contributing to ALD pathogenesis.

Title: THE IMPACT OF GREEN TEA ON MOOD DISORDER SYMPTOMOLOGY AND BRAIN DERIVED NEUROTROPHIC FACTOR: A SYSTEMATIC REVIEW

Primary Author: Aidan Cavanah

Additional Authors: Drew Fruge;Madison Mattingly;Laura Robinson;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Background: Mood disorders include symptoms of depression, anxiety, and or stress, and have increased in prevalence. Green tea and its bioactive components (epigallocatechin gallate [EGCG] and L-theanine) have been investigated for their health benefits and neuroprotective properties. As adults seek integrative and alternative treatment modalities, it is relevant to determine the effects of natural and non-pharmacological treatments on humans. Objective: This study aimed to assess current evidence from published randomized controlled trials testing the effects of green tea, green tea extracts, or its bioactive compounds on mood disorder symptomology and brain derived neurotrophic factor (BDNF). Methods: We searched PubMed, Cochrane Library, PsycINFO, Embase, Google Scholar and ClinicalTrials.gov, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist and utilizing predetermined inclusion and exclusion criteria. Results: A total of 445 studies were identified, 395 screened, and thirteen met inclusion criteria. Seven used one of the bioactive compounds found in green tea for intervention, while six used green tea extract, matcha or traditional green tea. Mood disturbance was assessed with several different tools, with several studies reporting improvements in depressive (n=4) and/or anxiety (n=4) symptoms. Conclusion: Our findings suggest green tea, GTE, L-theanine and EGCG may improve mood disorder symptomology. No evidence suggested effects of green tea and its bioactive components on BDNF.

Title: Refining age estimates of escorias from the Argentinian Pampas

Primary Author: Aidan Knox

Additional Authors:

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Escorias are green to black vesicular glassy ejecta formed by meteorite impacts commonly found in the Pampas region of Argentina. Once age-dated, these impact glasses can give valuable insight into the region's impact history, with potential implications for understanding Cenozoic faunal evolution recorded in the loess sequences. Recent studies report variability in escoria age estimates, suggesting multiple impact events or methodological inconsistencies. This research aims to refine age estimates of escorias using the $^{40}Ar/^{39}Ar$ mass spectrometry dating method while also assessing factors influencing analytical precision. Samples from a single stratigraphic level, previously dated to ~3.3 Ma, will be analyzed to test reproducibility and identify potential sources of error in sample preparation and analysis. By improving dating accuracy, this study seeks to resolve discrepancies in escoria ages and contribute to a more precise impact chronology for the Pampas region.

Title: Traumatic Experiences Among Diverse First-year College Students: A Qualitative Approach

Primary Author: Aisha Qazi

Additional Authors: Olivia New;Maddy Mcdaniel;Lauren Santaella;Kaitlyn Berry;Halei Adkins;Alyssa Carlota;Diana Samek;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Depression and anxiety symptoms are increasingly common among young people. We were interested in the extent to which trauma plays a role in this and how young people describe such trauma. A total of 195 diverse, first-year students were surveyed regarding their mental health, substance use, and potential risk and protective risk factors. The majority of these students (93.4%) provided a response to an open-ended question asking them to describe any trauma they experienced in the last year, illustrating the importance of this topic to this population. Thirty codes were identified by thematic analysis. Agreement of codes by up to eight raters showed excellent agreement (range 83.3% to 100.0%, M=98.5%). The most prevalent category of trauma coded was mass or school shootings (20.2%), which predominantly referred to those experienced vicariously (not directly). For example, "The event that stuck with me the most was the shooting at the college campus in Michigan because before I heard about it, I saw Tiktoks posted by people who were going through it" and it made them feel like they were "in the moment with them". The second and third most common codes were death of a loved one (15.8%) and events referencing broader political issues (7.7%). Anxiety was commonly reported in reference to experiencing trauma (13.1%). In conclusion, traumatic experiences matter to first-year college students. It is important to recognize how frequently they reported distress in relation to experiences, especially secondary traumatic events, such as mass or school shootings. Reducing the existence of such shootings is of paramount importance. At minimum, media coverage (including social media) should include resources for individuals viewing their content (e.g., national hotlines, digital mental health resources).

Title: Weed proliferation in crop fields: The unseen impact of poultry litter application in Alabama

Primary Author: Akashdeep Singh

Additional Authors: Rishi Prasad;Andrew Price;David Russell;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Poultry litter (PL), a nutrient-rich byproduct of Alabama's (AL) substantial broiler production, has been shown to enhance crop yield. However, its effect on weed proliferation is less understood. This study aimed to determine if there are any stimulatory effects of PL on weed emergence in Alabama corn fields under north AL silt loam soil and south AL sandy loam soil. PL 6-month, 2 years, and more than 2-year-old was applied to corn fields at a rate of at 2 tons/acre alone and in combination with nitrogen fertilizer compared to untreated plots. Monthly weed density and biomass data was collected from three 0.25 m2 quadrats. Results indicate that PL application increased weed density progressively with the increasing age of PL. Preliminary investigation in greenhouse indicated that PL used in this study was free of viable weed seeds, which suggests stimulatory effects of PL on weed seed emergence in the crop growing season. Further research is needed to fully understand these relationships and their implications for agricultural practices in Alabama. Future work will involve studies exploring different doses and sources of poultry litter.

Title: Amazonian invaders in the pearl of Indian Ocean: Species distribution model for Pterygoplichthys spp. In Sri Lanka

Primary Author: Akila Abesinghe

Additional Authors: Janaki Sandamali Kuda Udage;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Sri Lanka, an island in the Indian Ocean, hosts a diverse range of freshwater aquatic organisms, many of which are endemic or native. However, the introduction of invasive alien species poses a significant threat to native biodiversity. Among these, Pterygoplichthys spp. (sailfin catfishes), native to South America, have been introduced to various countries, including Sri Lanka, through the aquarium trade and have since naturalized. The most widespread species include Pterygoplichthys pardalis, P. disjunctivus, and their hybrids. However, the precise taxonomic identity of naturalized populations outside South America remains uncertain due to the absence of comprehensive phylogenetic studies. Sailfin catfishes are highly efficient algae grazers, often outcompeting native fish species. Their ecological impact includes alterations to bank structures and increased erosion, disruption of aquatic food chains, competition with native species, modification of aquatic plant communities, and damage to fishing gear and industry. In Sri Lanka, Pterygoplichthys spp. have been recorded across multiple aquatic habitats, spanning all three major climatic zones, and have invaded major river systems such as the Mahaweli, Malvathu, and Kelani rivers. Despite their widespread distribution, a comprehensive study on their range expansion and ecological impact in Sri Lanka is lacking. To address this gap, we employ Species Distribution Modeling (SDM) to predict the potential range of Pterygoplichthys spp. across the island. This study integrates species occurrence data with key environmental predictors derived from datasets such as WorldClim, BIOCLIM, and HydroSHEDS, which provide critical bioclimatic and hydrological variables influencing species distributions. MaxEnt, a widely used machine learning-based modeling tool, will be used to analyze species-environment relationships and generate predictive distribution maps. The anticipated results will offer insights into the spatial extent of sailfin catfish invasions and help inform conservation and management strategies aimed at mitigating their impact on Sri Lanka's native aquatic biodiversity.

Title: Emerging hot spot analysis of vegetation change within the blast zone of the 1980 Mount St. Helens volcanic eruption.

Primary Author: Alexander Burns

Additional Authors: Luke Marzen;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: The Mount St. Helens eruption of 1980 resulted in a catastrophic loss of 620 km2 of land within the Pacific Northwest. This area is known for producing 35% of the Nation's sawtimber, and the eruption resulted in nearly $700 million in lost timber. The eruption forced an ecological reset of the land within the blast zone. While the situation was tragic, it has led to many opportunities for studying how the landscape recovers following such an event. This study focused on the vegetation throughout the blast zone with a particular interest in comparing the vegetation on the different land ownerships or management areas. Using the Normalized Difference Vegetation Index (NDVI) for the years 1984 – 2024 in Emerging Hotspot Analysis (EHA), the results showed that vegetation health was distinctly greater on properties where there were more remediation efforts following the eruption. 97% of historically healthy vegetation following the 1980 eruption lies on Weyerhaeuser Timber Company property. Conversely, the National Volcanic Monument (NVM) property holds 95% of the diminishing cold spots of vegetation. Also, 98% of new hot spots of vegetation are located on lesser managed properties like NVM. This shows that these properties have historically had the poorest vegetation health, but the vegetation is continuing to get healthier. Our findings confirm that properties with the most intensive management practices have had the healthiest vegetation in the forty years following the eruption. This underscores the effectiveness of active restoration measures. The information gleaned from this study could help inform the property managers in the area and guide restoration practices in similar post-disturbance environments.

Title: Development of an Experimental Design to Measure CYP Enzyme Induction of Kratom Extracts and HIV Drugs in Sandwich-Cultured Primary Hepatocytes

Primary Author: Alexander Shipp

Additional Authors: Satyanarayana Pondugula;Angela Calderon;Zarna Atul Raichura;Destini Thornton;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

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 may interfere with drug metabolism in hepatocytes. Hepatocytes are the chief functional cells of the liver and complete drug metabolic functions which is why they were specifically chosen as they deliver more clinically translational data in terms of measurement of the CYP enzyme activity. To meet our research goal, the culture conditions need to be optimized. Hepatocytes can be cultured using various media and overlays so the use of the most reproducible hepatocyte environment allows for less variability in control parameters. As sandwich-culture hepatocytes are more physiologically relevant, we focused on determining the best overlay to use for our experiment. For experimental design development, we optimized our controls. We tested a sandwich-cultured assay where hepatocytes were grown for 24 hours. Then, either Optimatrix or Geltrex overlay was added, producing the sandwich culture. After an additional 24 hrs, medium was added to the negative control wells and rifampicin, omeprazole, or phenobarbital was added to the positive control wells. Then mRNA was extracted from hepatocytes and analyzed via qPCR to determine induction rates which validated that either Optimatrix or Geltrex had no significant influence on control parameters. Optimatrix was chosen to test Kratom, HIV ART drugs, or a combination of Kratom and HIV ART drugs. In summary, we developed an optimized experimental design to investigate the potential induction effects between Kratom and HIV ART drugs in human primary hepatocyte cultures.

Title: Accelerated Phase Diagram Mapping via Adaptive Sampling

Primary Author: Alexander Summers

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Phase diagrams are central to materials design, providing critical information on stability domains, phase transformations, and microstructural evolution as a function of composition and temperature. However, constructing such diagrams often involves time-consuming experimental campaigns or large-scale computational efforts. In this work, we present an active learning framework aimed at accelerating phase diagram mapping, reducing the number of required experiments or simulations while maintaining accuracy and reliability. We employ Gaussian process models and other surrogate models to quantify uncertainty across compositional–temperature space, selecting new sample points that are most likely to reduce global uncertainty about phase boundaries. We introduce a boundary-focused sampling strategy that concentrates resources in regions where phase transitions are likely to occur, thus rapidly clarifying phase boundaries. Additionally, we show that adding a small perturbation from exploration-based sampling pushes the acquisition strategy away from local maxima and allows more efficient sampling of the phase space. Through simulation-based case studies, we demonstrate that our active learning algorithms can drastically decrease the total number of sampling points needed to achieve robust phase diagrams. Finally, we show how this strategy can be applied to an experimental case where we aim to refine the parameter space of a laser powder bed fusion (L-PBF) metal additive manufacturing process towards the goal of producing high density metal parts.

Title: Doubling Down: The Dual Risk of Childhood Attachment Histories and Peer Victimization on Later Sleep Outcomes

Primary Author: Alexandra Ehrhardt

Additional Authors: Mona El Sheikh;Morgan Thompson;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Youth with a history of attachment insecurity in childhood are at increased risk for later negative peer experiences such as peer victimization. However, the long-term and multiplicative effects of attachment insecurity and peer victimization on sleep, a multifaceted domain of development linked to multiple health processes, remain uncertain. Guided by dual-risk models, this study tested whether children's attachment histories to mothers and fathers moderate the association between peer victimization in adolescence and sleep problems from adolescence into emerging adulthood. Data from 360 participants spanning ages 9-24 were used (45% female; 58% White, 27% African American; Mincome = 20-35k). Maternal and paternal attachment assessed via the Inventory of Parents and Peers Attachment at ages 9-10, and peer victimization measured via the Social Experiences Questionnaire at ages 15-17 were examined. Established sleep parameters in adolescence and emerging adulthood (ages 22-24) were assessed with actigraphy over one week. Variables included duration (minutes of sleep from onset to wake time), efficiency (% of time asleep from onset to wake time), and midpoint (chronobiology – morningness/eveningness preferences), with eveningness associated with worse developmental outcomes. This work was funded by NICHD R01-HD046795. Multivariate latent change score models revealed significant interactions for peer victimization with both maternal ($p = .002$) and paternal attachment ($p = .001$) in separate models. Decreasing attachment to either parent in childhood was associated with increased preference for eveningness from adolescence to emerging adulthood for youth who exhibited increasing, versus decreasing, peer victimization across adolescence. Supporting a dual-risk framework, findings suggest insecure attachments to both mothers and fathers amplify the effects of negative peer experiences in adolescence on long-term changes in sleep chronobiology.

Title: Understanding the effect of ultraviolet light exposure on modified and unmodified pigments in yellow songbirds.

Primary Author: Alexandra McGrew

Additional Authors:

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: In songbirds, plumage coloration is an honest signal of individual quality, utilized in key behavioral interactions such as sexual selection and territoriality. Loss of coloration in feathers, as a result of ultraviolet light exposure from the sun, could significantly impact an individual's reproductive success and survival. While many songbirds have been known to directly integrate yellow pigments found in food into their plumage coloration, other species use an enzymatic process to convert yellow dietary pigments, such as lutein, to alternative yellow pigments for their plumage, such as canary xanthophyll. Thus far, little research has been conducted investigating the significance of the evolution of this yellow-to-yellow conversion in birds. I hypothesized that modified yellow pigments are more stable and more resistant to degradation than dietary pigments. The purpose of this study was to investigate how UV light exposure deteriorates modified and unmodified yellow pigments to determine if deterioration rate varies based on pigmentation type. Thus, this project tests the hypothesis that prolonged UV light exposure would degrade the yellow coloration of feathers pigmented with dietary pigments more than it would degrade yellow coloration produced with modified pigments. Feather samples from 50 museum specimens across 10 species were collected and subject to a month-long exposure of UVA light (360nm wavelength). Reflectance curves were measured for each sample prior to and following the experimental period. The study is currently ongoing, and preliminary results will be discussed at the Symposium presentations. Significant results would suggest that modified pigments may serve an evolutionary advantage in preventing color deterioration. If modified pigments are more stable against UV light exposure, the presence of this conversion mechanism may be evolutionarily significant to plumage signaling across and within songbird species.

Title: Investigation of miRNA and mRNA profiles in fresh and frozen-thawed eastern oyster

Primary Author: Alexandra Nowicki

Additional Authors: Ian Butts;Scott Rikard;Andrea Tarnecki;Kaylan Martin;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: The eastern oyster (Crassostrea virginica) is an environmentally and economically important species that naturally occurs in the intertidal zone along the Atlantic and Gulf coasts of America. Natural populations of eastern oysters have experienced declines due to overharvesting, disease, pollution, and climate change. As such, assisted reproductive technologies (ARTs) are urgently needed to increase hatchery production yields for restoration and aquaculture. Cryopreservation of sperm is an ART that has been used to genetically improve hatchery lines through selection and storage of high-quality gametes. Unfortunately, a high degree of variability in post-thaw sperm quality has been reported. The reproductive potential of male oysters may be influenced by differential expression of genes (DEGs) related to gametogenesis. Additionally, microRNAs (miRNAs) have a regulatory role in the transcription of mRNAs and may impact the expression profiles of genes vital for sperm form and function. Thus, our objectives were to investigate gene expression profiles between (i) fresh sperm of high- vs. low-quality; (ii) males with high- vs. low sperm cryotolerance; and (iii) fresh vs. cryopreserved sperm. Semen was collected from twenty oysters and sperm kinematics (e.g. motility/velocity) were evaluated pre- and post-cryopreservation using computer assisted sperm analysis (CASA) software. RNA was extracted from fresh and cryopreserved samples and subjected to high-throughput sequencing. Analysis of mRNA and miRNA sequence data is ongoing. DEGs, gene ontology, and KEGG pathway analyses will be utilized to understand the biological functions for pre- and post-thaw sperm quality. These results will provide an understanding of molecular mechanisms in Eastern oyster spermatogenesis that can be applied to the development of sperm cryopreservation technology for oysters to enhance and sustain the oyster aquaculture industry.

Title: The “heartbeat” behind pharmacodynamics of marine bioactive

Primary Author: Alexandra Volk

Additional Authors: Muralikrishnan Dhanasekaran;Keyi Liu;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Cardiac arrhythmias, including tachycardia, bradycardia, and atrial fibrillation, as well as congestive heart failure (CHF), pose significant health risks, particularly following myocardial infarction. Research has shown that women generally have a higher resting heart rate and face an increased risk of cardiac arrhythmias during pregnancy. Although atrial fibrillation is more prevalent in men across all age groups, its morbidity and adverse outcomes tend to be more severe in women. Treatment for cardiac arrhythmias depends on the type, severity, and underlying cause of the condition. The therapeutic approaches can be classified into pharmacological and non-pharmacological approaches, including lifestyle modifications, medical interventions, and surgical procedures. The pharmacological approaches are beta-adrenergic antagonists, antiarrhythmic drugs (sodium, calcium, and potassium channel blockers) and adenosine, as well as non-pharmacological approaches (vagal maneuvers and catheter ablation). While these therapies help restore normal heart rhythm, they can also cause significant adverse drug reactions. Although the current antiarrhythmic drugs are effective, they can paradoxically induce new arrhythmias, increasing the risk of sudden cardiac death. Given these challenges, there is a growing interest in exploring marine bioactives as alternative prophylactic and therapeutic agents with potentially fewer adverse effects. A systematic literature review was conducted using PubMed, employing keywords such as “Marine Bioactives,” “Marine Compounds,” and “Marine Products”. Several marine-derived bioactive compounds have been identified with cardioprotective properties that may help mitigate the adverse effects associated with synthetic antiarrhythmic drugs. This review highlights the potential of marine bioactives as innovative prophylactic and therapeutic options for managing cardiac arrhythmias, offering a promising avenue for safer and more effective treatment alternative intervention.

Title: Primary outcomes of a crossover trial to assess tolerance, gastrointestinal distress, and preference for milks varying in casein types and lactose content

Primary Author: Alexandrea Pegel

Additional Authors: Drew Fruge;Michael Roberts;Derick Anglin;Madison Mattingly;Sarah Lennon;Aidan Cavanah;Laura Robinson;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Previous research indicates that GI discomfort from milk consumption may be attributable to A1 β-casein, rather than lactose intolerance alone. Recently, it has been demonstrated that A2 milk (free of A1 β-casein) consumption may result in fewer gastrointestinal (GI) symptoms compared to conventional milk containing both A1 and A2 β-casein, yet direct comparisons between A2 milk and lactose-free milk remain limited. In this five-week, double-blind, double-crossover study, we assessed the physiological responses to doses escalating in volume of lactose-free conventional milk (Lactaid), A2 milk, and lactose-free A2 milk in non-milk drinking participants. Each milk type was consumed over three separate weeks with three increasing doses across five days per week, and at least one week washout between sample types. GI symptoms were monitored for 24 hours post-consumption, blood glucose levels for two hours, and breath hydrogen levels for three hours. Sensory evaluation was completed for each sample. Fifty-three participants were consented and randomized, with five withdrawing prior to sample testing and one not completing the study. Overall, gastrointestinal symptoms were minimal, though statistically significant differences were observed on days 3 and 5[LD1] indicating higher ratings of abdominal pain, bloating and flatulence from Lactaid compared to either a2 sample. On days 1 and 3, lower ratings of bloating, flatulence were observed in a2 compared to a2 Lac. Breath H2 responses reflected anticipated lactose content, though H2 was higher in a2 Lac than Lactaid on Day 5. Methane remained stable in all participants across the five-week period. Thirty-three participants were deemed lactose intolerant and had higher fasting and average H2 for all samples. The only GI symptom corresponding to the increase in H2 among these participants was flatulence after a2 consumption. Surprisingly, flatulence was apparently higher for lactose tolerant individuals when consuming Lactaid compared to a2. These findings suggest that adults who avoid conventional fluid milk consumption may experience minimal GI discomfort from lactose- and/or a1-free milks.

Title: An Insight Into the Electronic Structure of Vanadium-Formate Anion

Primary Author: Alexandros Androutsopoulos

Additional Authors: Evangelos Miliordos;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: It is well known that global warming constitutes a hard nut to crack since human activities have provoked the accumulation of greenhouse gases in the atmosphere and by extension, the increase of Earth's average surface temperature. Carbon dioxide lies among the gases in question, as the exploitation of Earth's fossil fuels has resulted in an increase of its atmospheric concentration. To mitigate this issue, scientists have examined the carbon capture and utilization (CCU) approach according to which carbon dioxide can be converted into high-value chemicals such as methane, methanol, and formic acid. Methanol's production is of considerable interest since it can be used as fuel, produce H2 via reforming, and serve as energy carrier. As highlighted in our recent work, the use of molecular catalysts with electron rich metals (CERMAs) can be applied for the capture and conversion of CO2 into CH3OH. Within this context, the present work focuses on the investigation of the interaction between vanadium anion and carbon dioxide via high-level multi-reference methods with a view to providing an accurate description of the interaction in question. To the best of our knowledge, such a fundamental theoretical study is missing from literature.

Title: Perceptions of science and society content in undergraduate STEM courses

Primary Author: Alexis Logan

Additional Authors: Joanna Bennett;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: A comprehensive understanding of the relationship between science and society is fundamental to STEM education. However, traditional undergraduate curricula often prioritize scientific methodologies while neglecting potentially contentious issues at the intersection of science and society. To explore how students perceive the importance, benefits, downsides, and relevance of including socially relevant content within their discipline, we developed a survey to distribute at a large R1 institution. We compared the results across three major STEM fields. Students across all three disciplines believe STEM is essential for understanding the world. Across the three disciplines, a majority of students think that societal topics should be included in the class. The most commonly cited drawback of incorporating societal topics into STEM classes is that it takes away valuable class time. The most frequently mentioned benefit is that STEM helps students make sense of society and their daily lives. The second most commonly cited benefit for biology students was that societal topics create awareness within the classroom. STEM education keeps students informed about scientific advancements and equips them with knowledge applicable to real-life situations. Understanding these subjects is essential for comprehending the world and staying aware of scientific developments that could directly impact individuals. These results highlight the ongoing relevance of STEM in the context of specific disciplines and its impact on students beyond the classroom.

Title: Expanding the Alabama Authors of the 19th and 20th Centuries Digital Project

Primary Author: Alexis Stoffers

Additional Authors: Elizabeth Craig;

Department/Program: English

College: College of Liberal Arts

Abstract: Alabama Authors of the 19th and 20th Centuries is a digital humanities project developed and directed by Dr. Beverley Rilett and being expanded by assistant editors Alexis Stoffers and Elizabeth Craig. The goal of the project is to preserve Alabama's literary heritage by showcasing renowned authors along with the books they published. On the website, users can find author portraits, biographical sketches, publication details, book jacket images, and an interactive literary map highlighting the places they once called home. There are also several interactive visualizations, including a chronology of authors, a sunburst of authors and books, and a chronological heat map of books. The website initially launched at the beginning of 2024 with detailed information about 150 Alabama authors and is expanding its collection to include over 1,000 Alabama authors.

Title: Evaluating the resistance of Rudbeckia hirta and Rumex crispus to 6-PPDquinone and their potential use for runoff phytoremediation

Primary Author: Aline Christine Bernegossi

Additional Authors: Jiagen Geng; Dr. Nick Zou

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: The rubber additive 6-PPD (N-(1,3-dimethyl butyl)-N’-phenyl-1,4-benzenediamine) and its oxidation product, 6-PPD-quinone (6-PPDq), are emerging environmental contaminants widely detected in roadway runoff. Although their toxicity to aquatic ecosystems is well documented, few practical solutions exist to reduce their concentrations in stormwater. This study investigates the tolerance of two plant species, Rudbeckia hirta and Rumex crispus, commonly used in green infrastructure, to assess their potential for phytoremediation of 6-PPDq. Seeds of both species were exposed for 7 days to control conditions (no contaminants), environmentally relevant 6-PPDq levels (1-100 µg/L), and elevated concentrations (200-3,200 µg/L). Germination, fresh biomass, and growth parameters were compared to those of the control at a 95% confidence level. R. crispus was excluded from further evaluation due to all treatments' germination rates consistently below 65%. In contrast, R. hirta maintained robust germination, exceeding 75% under every 6-PPDq concentration tested, and showed no statistically significant reductions in hypocotyl or radicle length relative to the control ($p > 0.05$). Notably, at the highest concentration tested (3,200 µg/L), R. hirta exhibited a marked increase in fresh biomass (4.31 mg) compared to the control (3.18 mg, $p < 0.05$). These findings indicate that R. hirta tolerates a broad range of 6-PPDq levels without showing obvious phytotoxic effects, suggesting strong potential for further phytoremediation studies targeting tire-related contaminants. While the mechanisms behind this unexpected biomass increase require additional investigation, it may reflect an inherent adaptive or resilience response in high-contaminant environments. Subsequent research should focus on quantifying 6-PPDq uptake or transformation by R. hirta to verify its capacity for reducing contaminant loads in stormwater.

Title: Enhancing Contractile Function of Engineered Cardiac Tissues through Enriched Fatty Acid Media Cultivation

Primary Author: Alison Brown

Additional Authors: Mohammadjafar Hashemi;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Diabetic cardiomyopathy (DCM) is a heart disease that leads to cardiac structure and performance abnormalities in diabetic patients, particularly in adults. Human-induced pluripotent stem cells (hiPSCs) have been a strong candidate for disease modeling, but hiPSC derived cardiomyocytes primarily express an immature phenotype. Previous research by Dr. Mohammad Hashemi sought to improve mature contractile function of engineered cardiac tissue, creating a more-accurate model of native cardiac tissue for drug-testing and clinical trials. The current gold-standard growth media for differentiated hiPSCs induces glucose oxidation as the energy source for contraction, but in native cardiac tissue, glucose oxidation accounts for only about 30% of contraction energy – the main energy source is fatty acid oxidation. The purpose of this research was to expand upon Dr. Hashemi's work in assessing the maturity and physiological accuracy of cardiomyocytes differentiated in a fatty acid growth media. This was done by testing the sensitivity of engineered cardiac tissues (ECTs) to different key pharmacological drugs depending on which growth media the tissues were pre-treated with: RPMI/B27 media, or a maturation media with a higher fatty acid content to induce fatty acid oxidation. The three drugs that were tested were isoproterenol, propranolol, and verapamil, all of which have fast-acting effects on the contractile function of cardiac tissue. This comparison between ECTs grown in RPMI/B27 media and in fatty acid maturation media was determined quantitatively by measuring contractile velocities, contraction frequencies, and the fractional shortening of the tissues.

Title: Changes in college students' social media use and well-being from 2020 to 2024.

Primary Author: Allison Keller

Additional Authors:

Department/Program: Psychology

College: College of Liberal Arts

Abstract: The COVID-19 pandemic significantly affected college students, leading to mental health challenges including anxiety and depression. Poor mental health can adversely affect physical health factors such as sleep quality. The use of social media strongly impacts student well-being. Although it facilitates the support of connections, it may also lead to feelings of inadequacy and diminished self-esteem, stemming from social comparison and the fear of missing out (FoMO). This research investigated the impact of social media usage on students' mental health, contrasting experiences from the pandemic years (2020–2021) with those from the post-pandemic years (2023–2024). Participants completed a survey which was delivered via Qualtrics software. All participants ($n = 2055$) were asked questions about fear of missing out, frequency of social media use, types of social media use, motivations for social media use, anxiety, depression, and perceived stress. A one-way Multivariate Analysis of Variance was calculated to compare differences by cohort. Altogether, FoMO was stable across cohorts from 2020 to 2024, $F(3, 1969) = 2.37$, $p = .069$. Levels of anxiety $F(3, 1969) = 430.51$, $p < .001$, and depression $F(3, 1969) = 335.13$, $p < .001$ were similar between peak pandemic years but went down significantly post-pandemic in 2023 and 2024. Frequency of checking social media did not change across cohorts, but time spent on social media was significantly higher in 2023 as compared to the other terms, $p < .05$. Overall, FoMO was negatively correlated with depression, anxiety, stress, and social media use variables. Greater estimated time spent on social media was related to poorer mental health. These results suggest the pandemic did have a negative impact on student well-being but that this has improved. Social media use continues to impact student mental health. Future initiatives should explore potential interventions to mitigate negative effects of FoMO and social media use on students.

Title: Female first and senior authorship in pharmacy publishing

Primary Author: Amanda McAllister

Additional Authors: Ginny Jacobs;

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Women made up 59.6% of the pharmacist workforce and 56.7% of the medical scientist workforce per 2022 U.S. Census Bureau reports. 67.2% of the global health workforce were women in 2024 per the National Health Workforce Accounts. 1801 articles were published in the top ten high-impact journals in 2022 per SCImago Institutions Rankings (SIR). Current publishing statistics do not evaluate the proportion of female researchers to their representation in the pharmacist and medical scientist workforces. The purpose of this study was to evaluate characteristics of first and senior female authorship in the top ten high-impact pharmacy journals. The top ten pharmacy journals by 2022 impact factor were identified via SIR. Excluded articles included meeting abstracts, article corrections, and those not in English. The primary outcome was the prevalence of first and senior (last) female authorship. Secondary outcomes included credentials, article type, practice setting, and funding. Data was analyzed using descriptive statistics. Of the 1681 eligible articles, 74.4% had a first and/or senior female author. 58.5% had a female first author only while 46.3% had a female senior author only. 30.5% had both first and senior female authors. 44.0% had either a first or senior female author only. The most common credentials were PharmD (30.4%) and PhD (23.0%). Most articles were original research (67.9%), followed by reviews (8.2%) and commentaries (5.6%). Most practice settings were nonspecific settings (34.6%) and academic settings (24.3%). 32.8% of the 1251 articles with a first and/or senior female author received funding. The rate of female pharmacy publishing is 14.8% higher than the rate of women in the pharmacist workforce, 17.7% higher than in the medical scientist workforce, and 7.2% higher than in the global health workforce. Further evaluation is needed to determine the cause of female authorship rates and its significance to practice settings in the global health workforce.

Title: How do climate and pathogen diversity collide to drive disease outbreaks?

Primary Author: Amanpreet Kaur

Additional Authors: Ivory Russell;Rishi Bhandari;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Endemic foliar pathogens continue to reoccur with the limited success of disease management strategies, threatening food production systems. Rapid pathogen evolution, driven by climatic fluctuations and modern agricultural practices, increases the risk of disease outbreaks. Thereby, highlighting the need to understand their underlying causes and contributing risk factors of reoccurring disease epidemics. To address this, an integrated approach was developed to investigate the relationship of pathogen diversity and climatic factors with disease dynamics in the Xanthomonas-tomato pathosystem. Over three consecutive years, leaf samples from 22 tomato farms were collected, and a high-resolution metagenomics approach was employed. The data from the study revealed the co-occurrence of multiple pathogen genotypes with varying abundances, reflecting the global diversity of Xanthomonas across fields in the southeastern U.S. This differential pathogen dynamics was found to be shaped by climate-dependent fitness strategies. Despite this heterogeneity of pathogen structure, consistent seasonal oscillations of pathogen variants and positively selected loci across fields were observed. Ultimately, this study provides valuable insights into the factors driving within-host pathogen adaptations under climate change.

Title: Shared Clinical Decision-Making on vaccines among community pharmacists

Primary Author: Amatallah Saulawa

Additional Authors: Oluchukwu Maureen Ezeala;Kassi Scott;

Department/Program: Department of History and World Language and Culture

College: College of Liberal Arts

Abstract: Shared clinical decision-making (SCDM) on vaccines involves an open dialogue between a patient and their healthcare providers, including pharmacists, to make a patient-centered vaccination decision. SCDM recommendations apply when only specific groups of people would benefit from vaccination. The vaccines include: HPV for those aged 27–45; Meningococcal B for those aged 16–23 years; PCV20/PCV21 for those 65+ who completed previous pneumococcal series; Hepatitis B for adults 60+ with diabetes mellitus and 3rd+ dose of COVID-19 for immunocompromised persons. While the CDC provides guidelines for SCDM conversations, the provider determines whether and how to initiate such discussions. Given community pharmacists' increasing role in immunization and their high patient accessibility, this study aims to identify their barriers and facilitators to engaging patients in SCDM for relevant vaccines and describe how they determine which patients to approach for SCDM discussion. Recruitment is ongoing. Rural pharmacists were recruited from the Rural Research Alliance of Community Pharmacies network. Urban pharmacists are being recruited from the Harrison College of Pharmacy's alumni list and the Alabama Hayes pharmacist directory. Semi-structured interviews will be conducted until saturation. Transcriptions will be thematically coded and analyzed to identify patterns. Participants receive a $100 gift card as a participation incentive.16 interviews have been conducted to date. Preliminary results show varying levels of understanding and implementation of SCDM guidelines among pharmacists. Barriers to SCDM include limited time, pharmacists' limited knowledge of recommendations, and patient attitudes toward vaccination. Facilitators include pharmacist knowledge of and attitudes towards SCDM. The findings will inform strategies to bridge the gap between CDC guidelines and real-world practice. Pharmacists use dispensing software to identify ideal patients for SCDM.

Title: Carotenoid presence in the mitochondria of red songbirds

Primary Author: Amberlee Cook

Additional Authors: Geoffrey Hill;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Red coloration is a signal of individual quality in various vertebrate taxa such as fish and birds. In songbirds, this coloration is produced by the conversion of yellow dietary carotenoids into red ketocarotenoids. While some red songbirds, such as Northern cardinals, use a well characterized biochemical mechanism involving the CYP2J19 and BDH1L enzymes to do this, house finches use a mechanism that has not been characterized. In house finches, carotenoids are stored in the mitochondrion and are closely associated with its function. To test whether carotenoid storage in mitochondria also occurs in birds using the CYP2J19/BDH1L pathway, we trapped molting male house finches and cardinals. We then isolated their liver mitochondria, and measured carotenoid content. Analyses were repeated on mitochondria isolated from males of the same species during a non-molt period, to determine if mitochondrial carotenoids are tied specifically to feather pigmentation. We predicted higher carotenoid levels in the mitochondria of house finches, and higher levels during the molting season. We observed differences in coloration between the mitochondrial pellets of cardinals and house finches during the molting season, but not the non-molting season. We also observed lower levels of carotenoids in cardinal mitochondria compared to house finches during the molting season. These findings suggest that cardinals, and possibly other birds using the CYP2J19/BDH1L pathway, may not store carotenoids in their mitochondria. However, any connections to mitochondrial function in CYP2J19/BDH1L species remains to be established.

Title: Electropenetrography: A new tool to study probing and ingestion behaviors of mosquitoes

Primary Author: Anastasia Cooper

Additional Authors: Kathryn Reif;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Mosquitoes transmit pathogens that negatively affect human and animal health. A greater understanding of their blood-feeding biology and interactions with hosts and pathogens could be exploited to develop new targets for controlling mosquito-borne diseases. Unfortunately, mosquito probing (i.e., biting) behaviors are poorly understood because they occur inside opaque host tissues. Electropenetrography (EPG) can elucidate these behaviors by recording changes in electrical signals generated during probing. We used an AC-DC EPG with variable input resistors (Ri levels) to characterize the electrical signals (i.e., waveforms) generated by Culex mosquitoes (Diptera: Culicidae) during blood-feeding on human hands. In addition, we developed a murine model for EPG and procedures for synchronizing waveforms with video recordings to facilitate the correlation of waveforms with insect behaviors. Waveforms for Cx. tarsalis Coquillett, and Cx. quinquefasciatus Say included those previously observed and associated with probing behaviors in Aedes aegypti L. (Diptera: Culicidae): waveform families J (surface salivation), K (stylet penetration through the skin), L (types 1 and 2, search for blood vessels), M (types 1 and 2, ingestion), N (an unknown behavior which may be a resting and digestion phase), and W (withdrawal). However, we also observed variations in the waveforms not described in Ae. aegypti, which we named types L3, M3, M4, and N2. Different combinations of waveform types and differences in the probability of transitioning between the waveforms indicate plasticity in probing behaviors within and between mosquito species and on different hosts. This investigation expands our understanding of mosquito probing behaviors and is expected to facilitate future pathogen transmission studies and help identify new targets for pest and pathogen management.

Title: Soil Moisture and Texture Effects on Herbicide Resistance Expression in Italian Ryegrass (Lolium perenne ssp. multiflorum)

Primary Author: Andrew Ahlersmeyer

Additional Authors:

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Italian ryegrass is a winter annual grass weed that causes significant issues for corn, soybean, wheat, and small grain production in Alabama. Recent studies have documented resistance to glyphosate, ALS-, and ACCase-inhibitors throughout the southeastern U.S., and reduced control of Italian ryegrass is likely to be exacerbated by various climatic factors. The objective of this study was to document the effects of altered soil textures and moistures on Italian ryegrass growth and development following applications of glyphosate and pinoxaden. A greenhouse trial was conducted in 2024, in which seeds of a suspected-resistant Italian ryegrass population were planted in pots containing field soil. The three soil types used included a loamy sand, silt loam, and clay, representing three unique agricultural production regions of Alabama. Laboratory calibration methods were used to determine the average water holding capacity of each soil, and pots were irrigated daily at 10%, 20%, and 40% of each soil's water holding capacity to maintain constant moisture regimes (low, medium, and high, respectively). Labeled rates of glyphosate and pinoxaden were applied each pot, and various physiological measurements (injury, mortality, plant height, seed head production) were recorded thereafter. Neither glyphosate nor pinoxaden completely controlled Italian ryegrass, highlighting the significant presence of multiple-resistant Italian ryegrass in Alabama. However, varying soil moistures and textures had fascinating impacts on control using these foliar-applied, systemic products. For both herbicides, greatest injury was noted at low soil moisture levels. Control using glyphosate was significantly higher in the clay soil compared to the loamy sand and silt loam, but this trend reversed for pinoxaden. For plant height and seed head production, plants exposed to either no herbicide or pinoxaden responded as expected, i.e., taller plants and more seed heads with increased moisture and finer soil texture. However, glyphosate-treated plants grew the tallest and produced the most seed heads in clay soil under low moisture. Interestingly, these are the same conditions in which we noted highest visual control. These preliminary findings warrant replications of this research in 2025. Ultimately, we believe that these data will provide vital information to farmers and stakeholders in Alabama and the southeastern U.S.

Title: Angiotensin II Receptor- Associated Protein expression within cardiovascular nucleus during hypertension

Primary Author: Andrew Aitken

Additional Authors: Vinicia Biancardi;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Neurogenic hypertension (HTN) is a multifactorial disease defined by increased blood pressure within the arteries and characterized by an exacerbation of sympathetic activity. Among other pathways, increased sympathetic outflow is thought to be promoted by dysregulated Angiotensin II (AngII) signaling, mainly by the Ang II Type 1 Receptor (AT1R). The Ang II Receptor-Associated Protein (ATRAP) is an endogenous regulator of AT1R that promotes receptor internalization. Previous studies demonstrated that enhancing the expression of this protein through gene therapy within the brain-cardiovascular nuclei paraventricular nucleus of the hypothalamus (PVN) lowers blood pressure, though not to a normal level. However, whether ATRAP protein is differentially expressed within the PVN of Spontaneously Hypertensive Rats (SHR) compared to normotensive Wistar rats (WIS) is unknown. Given AngII dysregulation with the PVN of SHR's we hypothesized that ATRAP expression in SHR would be reduced within this nucleus compared to the normotensive animals. Using 12-week-old male SHR and WIS, we measured protein expression via immunofluorescence (IF) and used high-magnification full Z-stack confocal imaging for analysis. Further, we investigated if the expression of ATRAP protein was found not only in neurons but also within astrocytes since previous studies have shown that the latter can mediate AngII-driven elevations in pre-sympathetic neuron activity. ATRAP protein density was significantly decreased in PVN of SHRs compared to WIS (WIS: 31.21 ± 1.03 vs. SHR: 27.27 ± 0.81, $n=6$, $p<0.05$). Moreover, we found ATRAP colocalized both with a neuronal marker (NeuN) and astrocytes (GFAP). In summary, our findings suggest that reduced ATRAP protein expression, primarily in neurons and astrocytes, may hinder ATRAP-mediated internalization of AT1R, contributing to the exacerbation of AngII-AT1R signaling.

Title: Development of a High Throughput Screening Platform to Characterize Sensitivity of Cyanobacteria to Herbicide Mixtures

Primary Author: Andrew Barrick

Additional Authors: Md. Sayem Ahmed;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Issues arising from nutrients loads, water circulation, and temperature encourage blooms of harmful algae in aquaculture ponds. Copper sulfate is often used to treat harmful algal blooms. While effective, copper can accumulate in aquaculture ponds and make ponds too hazardous for commercial production. Use of alternative herbicides has been proposed however they are less effective than copper. As herbicides have different mechanisms of action, using multiple herbicides simultaneously may be more effective. A challenge with investigating the efficacy of herbicide mixtures is that traditional flask-based testing is too slow to test all potential permutations. High throughput, low-cost techniques to rapidly screen herbicide mixtures can facilitate the development of novel herbicide treatments. Research focused on Microcystis aeruginosa; a cyanobacteria known to commonly bloom in aquaculture ponds. Initial testing compared M. aeruginosa flask cultures to microplate cultures to determine if culturing vessel influenced sensitivity to copper. Results demonstrated that microplate cultures had comparable growth rates to flask cultures and that sensitivity to copper sulfate depended on endpoint measured. Preliminary testing exposed M. aeruginosa to herbicides commonly used in aquaculture ponds to establish benchmark doses for each chemical. Effect concentration (EC) where growth was inhibited by 50% were used to create binary herbicide mixtures. Five mixtures were prepared using different ratios of two herbicides and serial dilutions of each mixture were investigated to determine if herbicides were additive, synergistic, or antagonistic. Initial screening has indicated that binary mixtures are additive or antagonistic, which may be due to them having the same mechanisms of action. For herbicide mixtures to be effective, synergistic responses are necessary. Follow-up research will focus on herbicides with different mechanisms of action and more complex mixtures.

Title: Lignin nanoparticles and their application for mass timber coatings

Primary Author: Andrew Porter

Additional Authors: Fatimatu Bello;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Mass timber products, such as cross-laminated timber (CLT), serve as biobased alternatives to traditional building materials like concrete and steel, contributing to reduced carbon emissions in construction. However, CLT poses certain challenges, notably its susceptibility to UV degradation. Lignin, an amorphous aromatic polymer found in trees and grasses contains multiple light-absorbing molecules, and its structure can be modified through nanoparticulation to enhance its UV absorption capabilities. Thus, the aim of this study is to prepare lignin nanoparticles for incorporating biobased coatings for mass timber. The lignin nanoparticles (LNPs) were mechanically prepared from technical Indulin lignin using a Masuko Supermass Colloider. The process involved 12 passes at concentrations of 6% and 3% (w/w) lignin in deionized water. The impact of lignin concentration on the resulting particle size, zeta potential and polydispersity following mechanical treatment was investigated. Microscopy was used to examine the particles after each pass. Dynamic light scattering (DLS) was employed to characterize the zeta potential, hydrodynamic diameter, and polydispersity of the LNPs. Temperature data was also collected to monitor friction induced heat from the mechanical treatment. Additionally, energy consumption during the mechanical treatment was monitored using a 6-in-1 AC digital meter to measure power usage. After treatment DLS showed final particles with sizes ranging from 278 to 425 nanometers from 3% wt, to 6% wt. PDI values indicated similar sized particles. Temperature data peaked at around 87ºC which could cause agglomeration of particles, however in microscopy no significant aggregation was found. These findings suggest that the resulting nanoparticles are well suited for incorporation into bio based coatings for mass timber and CLT applications.

Title: Empowered Through Understanding: How Vaping Knowledge Influences Adolescents' Confidence in Refusing E-cigarettes.

Primary Author: Angela Mintah

Additional Authors: Adrienne Marks;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Adolescent vaping has surged to alarming levels, becoming a primary public health concern as e-cigarettes have emerged as the most commonly used tobacco products Bold Keyboard shortcut Ctrl+Bamong high school students in the United States. Recent estimates indicate that approximately 2.1 million students reported current e-cigarette use in 2023, with high school students engaging at rates surpassing those of their middle school counterparts. This trend demands urgent attention as it poses serious health risks, including addiction, respiratory issues (such as EVALI), and negative impacts on brain development. Adolescents often perceive vaping as a less harmful alternative to traditional smoking, influenced by the misconception that e-cigarettes lack the dangers associated with combustible tobacco. Such misperceptions may lead to risk-taking behaviors, thereby increasing the likelihood of vaping initiation among youth. The 2019 EVALI outbreak temporarily heightened vaping knowledge and risk awareness, suggesting that public health events and education may significantly influence adolescents' perceptions of vaping. However, despite these educational efforts, many adolescents remain influenced by peer group dynamics, seeking social acceptance and belonging, which may impact their confidence in resisting the urge to vape. Research indicates that when youth perceive vaping as less risky, they are more likely to be susceptible to vaping. By focusing on these factors, this research seeks to provide valuable insights from the implementation of an effective vaping educational program aimed at reducing vaping among adolescents. This study aims to explore the relationship between adolescents vape knowledge and their perceived confidence in refusing offers to vape while examining how perceived confidence to say no mediates the impact of vaping knowledge on how likely adolescents are to vape.

Title: Intentions to Use Opioid Sensor Devices: A Survey of Healthcare and Law Enforcement Professionals

Primary Author: Anne Taylor

Additional Authors: Xinyu Zhang;Renee Delaney;Karen Marlowe;Lindsey Hohmann;

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Background: Opioid misuse and overdose are major concerns in the US. The FDA has endorsed opioid sensor devices (OSDs) as potential tools for harm reduction. However, few OSDs are available, and the preferences of healthcare providers are unclear. Therefore, the purpose of this study was to assess differences in OSD beliefs across healthcare professions, as well as predictors of OSD utilization intentions. Methods: Alabama healthcare professionals were recruited via email to participate in a cross-sectional, anonymous online survey. The survey instrument was informed by the Unified Theory of Acceptance and Use of Technology (UTAUT). Primary outcomes were measured via 7-point Likert scales (1=strongly disagree, 7=strongly agree) and included intentions to utilize an OSD (3-items), perceived usefulness (3-items), ease of use (4-items), social acceptance (4-items), resource availability (4-items), and concerns regarding OSD utilization (3-items). Differences in mean outcome scale scores across medical (e.g., physicians, nurses) and pharmacy (e.g., pharmacists) professionals were analyzed using Mann-Whitney U tests ($\alpha=0.05$). Predictors of OSD utilization intention were identified via multiple linear regression, controlling for sociodemographic covariates. Results: Among 147 respondents, medical professionals (n=59) had higher mean[SD] intention to implement OSDs versus pharmacy professionals (n=37) (4.28[1.48] vs 3.43[1.76]; $p=0.033$). Perceived usefulness ($\beta=0.461$; $p<0.001$), social acceptance ($\beta=0.270$; $p=0.033$), and resource availability ($\beta=0.719$; $p=0.002$) were positive predictors of OSD utilization intentions. Conclusion: Medical professionals expressed greater interest in OSD utilization. Key predictors of intention included perceived usefulness, social acceptance, and resource availability. These insights can inform OSD development and implementation, supporting greater effectiveness in addressing opioid misuse worldwide.

Title: Development of early weaning strategies for largemouth bass, Micropterus salmoides, during early ontogeny

Primary Author: Anneleen Swanepoel

Additional Authors: Ian Butts;Timothy Bruce;Allen Davis;Luke Roy;Anita Kelly;Nelson Sharma Parajuli;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Largemouth bass (LMB) is rapidly expanding as a food fish in the U.S. Current farming practices of LMB occur in earthen ponds but high mortality rates have been reported during multiple stages of production. Indoor intensive recirculating aquaculture systems (RAS) may improve the high mortality rates observed during early rearing. Currently, there is a lack of information on optimal feeding strategies for LMB. Replacing live feeds with artificial diets is critical, as growing live feed is costly, labor intensive, and culture are prone to collapse. Therefore, the objective of this study was to determine the earliest time to wean fry onto artificial diets. Yolk-sac fry were reared in RAS that were stocked at 50 fry/L and fed 5 rotifers/L and 8 Artemia/L. Fish were administered six dietary treatments (4 replicates): Treatment 1 received no Artemia, Treatment 2 received Artemia to 5 DPH, Treatment 3 received Artemia to 10 DPH, Treatment 4 received Artemia to 15 DPH, Treatment 5 received Artemia to 20 DPH, and Treatment 6 received only artificial diet. All treatments were fed rotifers to 5 DPH and dry diet from 2 DPH. Mortality and water parameters, including dissolved oxygen, pH, and temperature were measured daily. Twelve fry were sampled weekly for morphometric measurements and stored in RNA/DNA shield at -80 °C for gene expression. A clear drop in survival was detected when fry were fed Artemia for 5 and 10 days. Fry had a bigger body area when fed Artemia at 7 DPH compared to treatments not receiving any live feeds. The same trend was observed at 14 and 21 DPH but no differences between treatments were observed on Day 28. This correlates with weight data at 30 DPH, also showing no differences between treatments. Based on these results, the earliest LMB fry can be weaned off Artemia is 15 DPH. This finding will improve hatchery production efficiency and growth dynamics for an economically important food-fish.

Title: Relationship between food security status and BMI among female college students

Primary Author: Ansley Scales

Additional Authors: Rita Fiagbor;Onikia Brown;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Food security, or consistent and easy access to nutritious food, is a major determinant in the overall health of college students. Differences in food security status, due to things like differences in financial situations or time constraints, can lead to differences in body mass index (BMI). Unhealthy BMI can have detrimental impacts on both physical and mental well-being. By comparing the BMIs of individuals with different levels of food security, conclusions can be drawn about what relationship exists between the two variables and how to best address health disparities relating to food insecurity. This study surveyed 558 female college students, ranging from freshmen to graduate students, to determine their food security status as either food secure or food insecure. Results showed that 23.66% of the participants experienced some level of food insecurity. This data was paired with data of the survey participants' BMIs. Data analysis showed association between a level of food insecurity and a BMI in the overweight/obese category. The findings from this study could suggest that food security may be adding to the already prevalent problem of obesity in the United States, especially among the college-aged population. The results further exhibit the need for increased awareness for those in college experiencing food insecurity and also encourage action to be taken to fight food insecurity to promote better health.

Title: Linguistic landscapes in Auburn-Opelika: Mapping diversity and accessibility

Primary Author: Anthony Espinal

Additional Authors: Daniel Vergara;Sarah Watts;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Linguistic landscapes provide a critical framework for analyzing language representation and sociocultural dynamics within communities. Prior studies emphasize the significance of documenting linguistic landscapes, often in areas where Spanish is highly visible in public spaces. This research builds on that foundation by exploring how Spanish functions in Auburn-Opelika's semi-urban environment, where its presence is less overt but remains embedded in culturally significant spaces such as businesses, schools, and religious institutions. Using a sociolinguistic methodology rooted in linguistic landscape research, this study systematically documents public signage, cultural artifacts, and hybrid linguistic markers (e.g., "Guate-Ameri-Mex") to assess Spanish visibility. Linguistic phenomena will be categorized on a 1–5 scale, with 1 indicating minimal representation of minority languages and 5 signifying high visibility. This spatial mapping method allows for an analysis of sociolinguistic distribution while preserving community anonymity, offering a structured approach to identifying linguistic patterns. By examining the intersections between language, space, and identity, this study provides a foundation for future research on the role of linguistic landscapes in shaping access to education, healthcare, and employment. Preliminary observations indicate that while English dominates public signage, Spanish appears in localized cultural and commercial hubs, suggesting that linguistic landscapes influence social engagement and resource accessibility. By mapping Auburn-Opelika's linguistic diversity, this research contributes to broaden discussions on language representation, community inclusion, and the evolving role of Spanish in public and institutional spaces.

Title: Context-aware learning for hyperspectral image analysis: Machine learning for atmospheric cloud classification with an educational LLM component

Primary Author: Aryavardhan Singh

Additional Authors: Dr. Olcay Kursun; Mr. Randy Russell; Shivaji Mallela;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: In atmospheric science, accurate cloud classification is essential for understanding weather patterns and climate dynamics, yet traditional classification methods struggle with variability. Traditional imaging often relies on the macroscopic shapes and spatial structures of clouds for classification, which can be inconsistent due to changing atmospheric conditions. Hyperspectral imaging (HSI) captures spectral data across wavelengths, identifying materials and atmospheric conditions beyond what traditional imaging can detect. Context plays a crucial role in both HSI analysis and modern AI techniques, enabling more robust classification by integrating spectral and spatial information. In this study, we apply context-aware machine learning to hyperspectral atmospheric cloud classification, leveraging both spectral and spatial information. Our dataset consists of hyperspectral sky images captured using a Resonon PIKA XC2 camera, recording 462 spectral bands from 400 to 1000 nm at 1.9 nm resolution. The dataset includes 33 parent images, each 4402 × 1600 pixels. We extracted 10–20 patches (50 × 50 pixels) per image, resulting in 444 patches across seven cloud and sky condition classes. Instead of treating each pixel independently, we embed patch-based contextual information into the feature representation. A final classifier trained on these enhanced representations improves accuracy over models using only spectral data. We also integrate a large language model-powered chatbot for dissemination, assisting users with camera setup, data collection, and machine learning workflows. While NSF funding is concluding, opportunities remain to improve classification models, expand the dataset, and explore new HSI applications. Our research enhances cloud classification accuracy and highlights HSI's potential in atmospheric science, remote sensing, and AI-driven environmental monitoring, advancing research and education. The dataset is publicly available on IEEE DataPort.

Title: Recombinant protein interactions impact efficacy of multivalent F. covae vaccine in channel catfish (Ictalurus punctatus)

Primary Author: Ashley Desilva

Additional Authors: Megan Justice;Victoria Quiroz;Emily Churchman;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Columnaris disease caused by Flavobacterium covae is a deadly bacterial disease that forms a biofilm on fish gill tissues, leading to ~11 million USD/year in losses for Alabama catfish production. Studies have shown that several F. covae proteins are upregulated during biofilm formation, making them potential vaccine candidates. Proteins of interest (FcP1 and FcP2) were cloned and expressed in E. coli, then purified under native conditions. Channel catfish were injected intraperitoneally with the purified proteins (20 µg/mL), and 30 days post-inoculation the vaccinated fish showed an increase in IgM antibody titers relative to control fish. Each fish then received a dose (1 µg/mL) of FcP1, FcP2, or both via bath immersion. Immersion with FcP1 or FcP2 provided significant protection against columnaris disease. However, the combination of both proteins was significantly less protective. It's hypothesized that there were protein-protein interactions between FcP1 and FcP2 that negatively impacted vaccine efficacy. Polyacrylamide-gel electrophoresis (PAGE) indicted that there was no protein dimerization or degradation in both native and denatured conditions when FcP1 and FcP2 were resolved on a PAGE gel together. When using epitope mapping techniques for the protein sequences of each purified protein, there more epitopic regions predicted for FcP1 than in FcP2, which could explain why FcP1 appeared to be more effective as a vaccine in protecting fish against this pathogen. We are currently evaluating activity for the respective proteins to determine if the change in vaccine efficiency is due to lack of activity for either of the proteins, and results from these protein activity assays will be presented for discussion. These findings have the potential to help protect farmed fish against columnaris disease as a benefit for the U.S. aquaculture industry.

Title: Alzheimer's disease histopathological phenotype in feline GM1 and GM2 gangliosidosis

Primary Author: Ashli Evans

Additional Authors: Douglas Martin;Malia Walton;Arthur Zimmerman;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Alzheimer's Disease (AD) is a degenerative brain disorder and the most common form of dementia. The presence of amyloid-beta (Aβ) plaques, neurofibrillary tangles (NFTs), and loss of neuronal connections are hallmarks of this disease. Unfortunately, current therapies do not slow AD progression substantially, and the overwhelming majority of new, potential therapies fail in clinical trials. Major roadblocks for development of new, effective therapeutics for AD have been the lack of authentic animal models and our incomplete understanding of the pathological onset and progression of the disease. Gangliosidosis, a rare lysosomal disorder, is associated with ganglioside buildup in the brain, and there is much literature suggesting ganglioside-bound Aβ (GAβ) accelerates Aβ accumulation and is enriched within neurons of AD patients. Therefore, we hypothesize that gangliosidosis affected cats could be a novel model for studying progression of AD pathogenesis and for testing current and new AD therapies. We examined several different brain regions in gangliosidosis affected cats and age-matched controls for the presence and subtypes of amyloid plaques as well as distribution of phosphorylated Tau (pTau), the driver of NFT formation. Our results suggest that the plaques and NFTs in gangliosidosis cats correlate with AD progression. Specifically, plaques appear earlier in regions affected during early stages of AD, and increase in likelihood and number during the later stages of gangliosidosis in a manner comparable to later stages of AD. In addition, the progression of plaque subtypes and distribution of pTau throughout the brain of gangliosidosis cats may reflect the same pattern of progression in AD. Overall, our data support the hypothesis that gangliosidosis cats are a novel model for the study of AD pathogenesis and for the testing of AD therapies.

Title: Toxicity of insecticidal gel baits against several developmental stages of American cockroach Periplaneta americana (Blattodea: Blattidae)

Primary Author: Ashmita Sapkota

Additional Authors: Arthur Appel;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The American cockroach (Periplaneta americana (L.); Blattodea: Blattidae) is an important peridomestic pest with high significance in public health. This study evaluated the toxicity of eleven gel-based insecticidal products containing active ingredients such as abamectin B1, boric acid, clothianidin, dinotefuran, emamectin benzoate, fipronil, imidacloprid, and indoxacarb, against several developmental stages of P. americana (adults of both sexes and nymphs of varying sizes). A completely randomized block design was used to estimate mortality and median survival times (MSTs) over a 14-day period. Gel baits, preferred for their efficacy in sensitive environments and reduced environmental contamination, demonstrated variable effectiveness. Hotshot (Dinotefuran 0.05%) and Alpine (Dinotefuran 0.5%) did not cause significant mortality ($P > 0.05$) compared to the control across small and medium nymphal stages. Except for the female adults, these two insecticides were comparatively less effective than others. Combat gel bait (Fipronil 0.05%) and MaxForce FC Magnum (Fipronil 0.05%) exhibited the highest efficacy, achieving the lowest MST of 24 h across all tested stages. All other gel baits were also competitively effective for all the developmental stages. Boric acid (33.3%), except for small and large nymphs, was efficient in controlling other stages of P. americana. These findings highlight the potential of fipronil-based gel baits as a reliable tool for managing all the stages of P. americana populations, emphasizing the importance of active ingredient selection for optimal pest control.

Title: Investigation of process parameter influence on additively manufactured polymeric fibrous structure

Primary Author: Ashok Sapkota

Additional Authors: Sabit Adanur;Shree Kaji Ghimire;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Fused deposition modeling (FDM) process parameters influence the mechanical behavior of the printed parts. Optimization of parameters like extrusion temperature, layer height, print speed and infill density can be done to enhance the performance of the part under different loading conditions. Capability to process a variety of materials, the ability to generate quick and personalized design makes FDM a desirable process to manufacture fabric structures. However, the mechanical properties are often compromised. This research attempts to optimize extrusion temperature, layer height and print speed for manufacturing of 2/1 twill woven fabric structure for desired tensile and flexural properties. In this work, Taguchi robust design is used for experimental design. Fabric samples and yarns, made from Polylactic acid (PLA), are subjected to tensile and flexural loading. Tensile strength, tensile modulus, flexural strength and flexural modulus are recorded and optimized using commercial software MINITAB. The order of influence of process parameters on fabric is varied for different properties evaluated. Either extrusion temperature or layer height is reported to be the most influential process parameter to the fabric sample. In contrast, print speed does not have significant effect on most of the properties studied. Additionally, the mechanical properties of fabric in weft direction are reported to be lower as compared in warp direction. The nature of the parameter influence is also different in two fabric directions. This phenomenon is due to the dissimilar material deposition in the warp and weft direction of the fabric.

Title: Type 2 Diabetes Mellitus Patients' Preferences for NAFLD/NASH Diagnostic Tests: A Discrete Choice Experiment

Primary Author: Asmita Priyadarshini Khatiwada

Additional Authors: Surachat Ngorsuraches;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Understanding patient preferences for various Non-alcoholic fatty liver disease (NAFLD)/non-alcoholic steatohepatitis (NASH) tests in type 2 diabetes (T2D) patients is essential for improved doctor-patient communication and treatment decisions. This study aimed to determine T2D patients' preferences for NAFLD/NASH diagnostic tests. A cross-sectional, web-based discrete choice experiment (DCE) survey was conducted. Six attributes of the tests and their levels, including fasting time, invasiveness, sensitivity, specificity, prediction of liver-related events, and out-of-pocket cost, were identified from literature and consultations with clinical experts and T2D patients. A D-efficient design was used to generate DCE choice tasks. Each choice task included two alternatives and an opt-out alternative. Data was collected from 226 T2D patients aged 18 years or above through the QualtricsXM panel. Mixed logit and latent class models were used to elicit preferences, examine preference heterogeneity, and the relative importance of attributes. Only 218 patients were included in the analysis. The preference weights of all attributes except fasting time were statistically significant and in the expected direction. The cost (0.58) has the largest impact on the patient's preference, followed by the specificity (0.14 and sensitivity (0.12) of the test. Significant preference heterogeneity was observed for all attributes. The latent class analysis identified two classes with class probabilities of 65.8% and 34.2%, with the first class mainly prioritizing sensitivity, specificity, cost, and prediction of liver-related events and the second class prioritizing cost and invasiveness. This study showed variability in the T2D patient's preferences for NAFLD/NASH tests, with cost being a dominant concern. While fasting time did not strongly influence the preference, the variability in preferences for other attributes highlights the need to engage patients in clinical decision-making.

Title: Effects of lower-extremity impulse forces on maximal proximal segment rotation velocity in collegiate softball hitters

Primary Author: Aubrie Lisenby

Additional Authors: Gretchen Oliver;Billy Lozowski;Anthony Fava;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Hitting performance (bat speed/exit velocity) is linked to lower body power, energy transfer, and proximal-to-distal sequencing. A hitter's ability to apply ground reaction forces to generate energy and rotate proximal segments is crucial for enhanced performance. This study investigated how lower-extremity (LE) impulse forces relate to maximal rotation velocity (RV) of the pelvis and trunk in softball hitting. Ten Division I collegiate softball hitters (20 ± 1y; 1.7 ± 0.1 m; 79.4 ± 9.2 kg) performed five maximal-effort swings off a tee. Kinematic data were collected using an electromagnetic tracking system (240 Hz), and ground reaction forces were measured with two force plates (1200 Hz). Normalized impulse forces were calculated by integrating force values over the acceleration phase (LL loading to ball contact). For linear relationships. Simple regressions assessed linear relationships between LE impulse forces and max RV, while quadratic models explored non-linear trends. Normalized Z impulse of the RL (to 2nd base) explained 34.2% of the variability in trunk RV (R^2adj=26.0,CI=-661.9–10824.5),and normalized Y impulse on the LL (vertically) accounted for 21.6% of pelvis RV variability (R^2adj= 11.8,CI=-742.1-3431.8). Neither model, however, was statistically significant (ps > .05). Quadratic regressions increased the explained variance in max RVs from impulse forces. Results suggest a function of minimizing impulse toward 2nd base on the RL while maximizing vertical impulse on the LL aids proximal segments' max RVs. Yet, a nonlinear trend included a more balanced vertical impulse on the RL (inverted U shape) which benefited max pelvis RV. Quadratic regressions may lend themselves to better interpretations of how hitters apply LE forces for rotation instead of simple linear relationships. Understanding these relationships can help coaches and athletes refine training to optimize force application and rotational mechanics to enhance bat speed in softball hitters.

Title: Exploring the impact of family and peer attitudes on help-seeking behaviors among Black men

Primary Author: August Stine-Woods

Additional Authors: Marilyn Cornish;Nicholas Johnson;LaJae Coleman-Kirumba;

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

College: College of Education

Abstract: Black Americans face similar mental health issues as White Americans but receive lower rates of mental health care compared to other ethnic groups. Understanding factors that contribute to this treatment gap are critical to improving personal well-being among Black Americans. Family and peer attitudes can shape one's beliefs about mental health and whether one will seek help. Examining family and peer attitudes expressed to Black men can help increase help-seeking rates, ultimately improving their overall well-being. In this study, we examined Black men's perceptions of family members' and peers' attitudes about psychological help-seeking when they were growing up. One hundred and forty-six Black men provided written responses to the question: "What were the attitudes of family members and peers regarding seeking psychological help when you were growing up?" Through content coding, we created a codebook to represent the themes within the data. Through three rounds of coding, interrater reliability analyses, and codebook revisions, we finalized twenty-one codes that reflected help-seeking messages. Emerging higher-order themes include barrier, ambiguous, positive, cultural, and conditional messages about help-seeking. For example, barrier messages suggested attitudes that either viewed the person seeking help negatively or viewed help-seeking itself negatively. Positive messages suggested supportive attitudes, including those actively encouraging help-seeking. Cultural messages recommended cultural alternatives to mental healthcare, including religion and self-reliance. Conditional messages included several themes about seeking help in only limited situations. Ambiguous messages left participants unclear about their family and peers' views on mental health. This study addresses gaps in the literature to better understand how family and peers may influence the way Black men view and seek psychological help.

Title: Dual inhibition of phosphodiesterase 5 and carbonic anhydrase with novel sildenafil derivatives for the treatment of Alzheimer's dementia

Primary Author: Austin Moore

Additional Authors: Gary Piazza;Adam Keeton;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Alzheimer's dementia (AD) currently impacts over 55 million people worldwide, with an annual incidence of 10 million cases. Currently, there is no cure for AD and available therapies only slow disease progression. Recently, carbonic anhydrase (CA) and phosphodiesterase 5 (PDE5) inhibition has been shown to have potentially beneficial effects in AD in vitro and in vivo. FDA-approved CA inhibitors, acetazolamide (ATZ) and methazolamide (MTZ), reduced amyloid-beta (AB) mediated apoptosis of neurons by reducing AB deposits, decreasing active caspase-3, and restoring capillary flow disturbances in brain vasculature. Further, observational studies in humans and experiments in animal models show that PDE5 inhibitors, may also have protective effects against neurodegeneration. Here, we investigated the potency and structure-activity relationships among a series of novel sildenafil derivatives designed to have dual PDE5 and CA inhibitory activity. PDE5 inhibition was tested using fluorescent polarization IMAP technology using recombinant PDE5. The derivatives were first screened in a high throughput format followed by detailed dose-response analysis to assess potency using sildenafil as a benchmark inhibitor. CA inhibition kinetics were determined using stopped-flow spectrometer and recombinant CA isozymes. Investigations using Glide software were carried out to determine docking scores for identifying relevant structure-activity relationships. Further, CA was co-crystalized with select inhibitors to determine interactions using x-ray diffraction to 1.11 angstroms. Our results showed several derivatives were more potent than sildenafil for PDE5 inhibition with low nM IC50 values and potent CA inhibition similar to ATZ across multiple CA isozymes with low nM Ki values. Efficacy studies in preclinical models of AD are currently being conducted. This project presents a promising potential for improved treatment approaches in Alzheimer's Disease with dual target inhibitors.

Title: Knowledge, attitudes, and willingness to pay for over-the-counter (OTC) naloxone: A nationwide cross-sectional survey

Primary Author: Autumn Randles

Additional Authors: Asia White;Melissa Sanders;Kat Smith;Emma Tidmore;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Naloxone, a medication that can reverse opioid overdose, was approved for over-the-counter (OTC) sale in the U.S. in March 2023 to help reduce mortality. However, little is known about the U.S. general public's awareness and willingness to purchase OTC naloxone. This study aimed to explore public knowledge, willingness to pay, and attitudes toward OTC nasal spray naloxone. A cross-sectional study recruited U.S. participants ≥ 18 years old to participate in an anonymous online survey via Amazon's Mechanical Turk (MTurk). Multiple-choice questions were used to assess knowledge and awareness of OTC naloxone, open-ended and closed-ended questions to evaluate willingness to pay, and a 5-point Likert scale to measure general attitudes. Measures were analyzed using descriptive statistics with SPSS software. Of 299 survey respondents, most (81.9%) had heard of naloxone, but only 31.8% were aware of its OTC approval by the FDA. Participants reported being willing to pay an average of $27.05 (SD=25.44) for OTC naloxone, with 18.7% willing to pay $20-25, and 72.5% choosing prices ≤ $25. All participants indicated that they would not purchase OTC naloxone if it costs > $50. General attitudes about OTC naloxone were positive (mean [SD] scale score: 3.67 [0.572]), with 85.2% agreeing or strongly agreeing that OTC naloxone is beneficial, and 85.5% responding that they would purchase OTC naloxone if needed. Only 7.7% thought OTC naloxone would not work as well as prescription-only naloxone. Although knowledge and awareness of naloxone was high, awareness of its recent OTC status was low, indicating a need for further education. The public's overall attitudes regarding OTC naloxone were positive, suggesting the perceived effectiveness of OTC naloxone is on par with the prescription-only version. As our study suggests that the U.S. public is willing to pay approximately $25 for OTC naloxone, future studies should explore pricing and strategies to improve access to OTC naloxone.

Title: Investigating the Impact of Stigma and Awareness on College Students' Access to Food Aid Resources at Auburn University

Primary Author: Avery Crist

Additional Authors:

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Food insecurity on college campuses is a growing concern. However, lack of awareness about the availability of resources, coupled with the stigma surrounding food aid, can have harmful consequences on students seeking support. This research assesses the relationship between stigma, resource awareness, and food insecurity among Auburn University students. The study revealed that limited awareness of resources and perceived stigma contribute to food insecurity, negatively impacting students' academic performance, personal health, and overall well-being. A questionnaire was distributed to undergraduate and graduate students at Auburn University to gather qualitative and quantitative data on their experiences with food insecurity, knowledge of available resources and students' response toward seeking food assistance. The study also put into consideration demographic factors such as housing status, student employment, and financial aid, while Likert-scale analysis was employed to assess the perceptions of students toward food aid. Results indicated that a significant portion of students experience food insecurity, with many unaware of existing resources. Additionally, perceived stigma around food assistance reduces the likelihood of students seeking the support they need. These findings will inform campaigns and initiatives aimed at reducing stigma, increasing resource awareness, and ensuring all students can access the necessary support they need.

Title: Fabkin and metabolic health: Unraveling its role in insulin regulation

Primary Author: Ayra Aziz

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

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Fabkin is a recently discovered adipokine that plays a crucial role in metabolic processes, specifically insulin regulation and lipid metabolism. Research has shown that Fabkin contributes to the secretion of insulin from beta cells within the pancreas and can provide therapeutic potential in controlling certain metabolic disorders like obesity and diabetes mellitus. Altered Fabkin levels are often studied in people who have a BMI above 30 as an interference in the process of Fabkin is connected to obesity and other metabolic disorders. In the United States, 40.3% of adults aged 20 years and older live with obesity, with this being a strong risk factor for diabetes mellitus. More specifically, Type 2 diabetes mellitus (T2DM) is a worldwide health concern associated with damage regarding the secretion of insulin and its resistance and affects 6.28% of the global population. Currently, the treatment for T2DM is to improve the control of blood sugar, and this can be done through medications and insulin infusions. Although insulin therapies continue to progress, formulations like rapid-acting, long-acting, and ultra-long-acting insulin it is expensive to make and difficult to manage. Certain psychological and economic features create a barrier to proper treatment, which impacts one's overall health. This leads to the need for tailored healthcare methods to provide successful treatment amongst diverse populations. As such, this study focuses on deepening our understanding of the adipokine, Fabkin, and its role in the regulation of insulin and lipid metabolism, with a discussion on the future of applications of Fabkin research with the ultimate goal of further discovering treatments for metabolic disorders. A comprehensive literature review was carried out utilizing the databases of PubMed, Google Scholar, Scopus, and Embase. Studies that combined important phrases like "Febkin," "Adipokines," "hyperglycemia," and "T2DM" were analyzed. As more research on the regulatory pathways and molecular mechanisms of Fabkin continues, the potential for improving results in patients suffering from obesity-related insulin resistance and management of diabetes mellitus grows, which encourages a further examination of Fabkin.

Title: Everyone's an ESL teacher: Reading strategies used by mainstream classroom teachers to support limited English proficient multilingual learners

Primary Author: Barbara Quintard

Additional Authors:

Department/Program: Department of Curriculum and Teaching

College: College of Education

Abstract: Although public school districts are legally required to provide English language development (ELD) instruction to multilingual learners (MLs) with limited English proficiency (LEP), this targeted ELD instruction is often limited to an hour or less per school day and insufficient to address the immediate academic needs of LEP MLs who are in mainstream classrooms for the other five to six hours a day. These vulnerable students who have varying levels of first language (L1) literacy are frequently thrust into the mainstream classroom with little to no support in accessing content, and teachers in these classrooms are generally ill-equipped to provide the necessary support. Specifically, the complex texts with which high school students are expected to engage can present seemingly insurmountable challenges to teachers untrained in second language acquisition and literacy development when tasked with accommodating MLs to access these texts. In order to determine mainstream classroom teachers' current practices as well as areas of need when supporting LEP MLs in reading grade level and content specific texts, K-12 teachers in a rural district in Tennessee were surveyed to establish what strategies they regularly employ to aid MLs in accessing texts before, during, and after reading, and what types of professional development they would like to receive to further develop their strategy repertoire. In addition to the survey, classroom observations and brief participant interviews were employed to establish a more well-rounded view of teachers' current practices and needs. The results of the survey, observations, and interviews will be used to craft relevant professional development opportunities for teachers within the district in effective text engineering and reading strategies to support LEP MLs in engaging with texts in their mainstream content classrooms.

Title: Transcriptomic analysis of 3D engineered tissues grown in hydrogel microspheres.

Primary Author: Benjamin Gunasekaran

Additional Authors: Elizabeth Lipke;Yuan Tian;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: More physiologically relevant compared to two-dimensional cell models, three-dimensional cancer tissues have increasingly been used in drug screening, especially self-aggregated spheroids made with ultra-low attachment (ULA) plates. However, this approach lacks control over the stiffness of the extracellular matrix (ECM), a critical factor for tumor microenvironments, and the ability to support non-aggregating cells. An emerging technique to be used for commercial purposes involves using microfluidic devices to produce cell-laden hydrogel microspheres. The microspheres provide an artificial ECM for encapsulated cells, allowing for control over microenvironment properties. Hydrogels are also useful for forming three-dimensional tissues of cells that do not tend to aggregate. For example, metastatic cancer cells are not likely to aggregate with one another, and it is more difficult for them to form a self-aggregated spheroid within a ULA plate. The artificial ECM in the microspheres provides scaffolds for these types of cells to form three-dimensional tissues, and the more biologically relevant environment for growing artificial tissues can be used to test new pharmaceuticals, particularly anti-cancer agents. This research focuses on comparing the hydrogel microspheres to the aggregates using bioinformatics tools. A bioinformatic pipeline will be developed to compare the difference in gene expression, and data from The Cancer Genome Atlas (TCGA) will be used to test and ensure a working pipeline. Application of the bioinformatic pipeline to gene expression data gathered from three-dimensional aggregates and hydrogel microsphere aggregates via RNA sequencing will ideally show that tissues formed within a hydrogel microsphere are equivalent or better than those formed via ULA plates.

Title: Enhancements to solar spectral scaling for fluorescence efficiency calculations of atoms in cometary comae

Primary Author: Benjamin Lightfoot

Additional Authors: Dennis Bodewits;John Noonan;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Comets are remnants from planetary formation, which, when sufficiently heated, spew off gas that contains key chemical information from our early solar system. However, to accurately characterize the atomic species in such gas first requires precise fluorescence efficiency values, which in turn require access to a high-resolution solar irradiance spectrum, which in turn requires scaling with daily cadence observations. This is as cumbersome of a process as it sounds, with substantially varying, and often ill-defined, methods in the literature. Recent developments in spectrum modeling and accessibility have significantly improved the quality of spectral data, but spectral scaling has remained a formidable obstacle. Methods which combine Gaussian convolution and polynomial fitting have shown promise – nevertheless, such fits were applied to low-resolution, interpolated data, and thus could not ensure that flux was properly conserved during the operation, or that error mitigation would hold for high-resolution transformations. In light of these limitations, the focus of this research has been on the development of a more rigorous approach to scaling, while still drawing on insights gleaned from previous efforts. We have found that, by leveraging an additional down-sampling transformation (with flux conservation within a ~5-10% margin), we can directly fit high-resolution data without undermining comparisons to low-resolution cadences. This new methodology has produced impressive preliminary results; it appears to offer comparable integrated flux values to NASA's NNL model and to GOES-18 measurements for key emission features, can maintain the integrity of spectral uncertainty calculations, and has opened the door to further benchmarking and validation checks that were previously infeasible. But most importantly, it provides a traceable, systematic means of producing high-resolution spectra in a critical region for atomic species analysis.

Title: ROR1/2 patterns the anterior neuroectoderm and is essential for endomesoderm specification during early development of sea urchin embryos

Primary Author: Boyuan Wang

Additional Authors: Ryan Range;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The receptor tyrosine kinase-like orphan receptor (ROR) is an important Wnt signaling receptor and/or co-receptor shown to transduce both canonical and non-canonical Wnt signaling pathways. In sea urchin embryos an integrated network of canonical (Wnt/β-catenin) and non-canonical (Wnt/JNK and Wnt/PKC) signaling pathways specify and pattern the early germ layers (endoderm, mesoderm, and ectoderm) along the anterior-posterior (AP) axis. In this study we show that ROR1/2 transcripts are co-expressed with many components of the Wnt signaling pathways that govern early AP formation in sea urchin embryos. Functional knockdown experiments indicate that ROR1/2 is necessary for the positioning of the anterior neuroectoderm (ANE) gene regulatory network (GRN) around the anterior pole of the embryo. These results are remarkably similar those observed in our functional studies of the non-canonical Wnt1/Wnt8-Fzd5/8-Sp5-JNK signaling pathway. Rescue experiments suggest that ROR may form a complex with Fzd5/8 and Wnt8 to activate the Wnt-JNK pathway. Additionally, ROR and Fzd5/8 appear to regulate each other's expression levels during early development to ensure the proper and accurate functioning of the Wnt-JNK pathway.Unexpectedly, we also found that ROR1/2 is necessary for the maintenance of the endomesoderm GRN during blastula and early gastrula stages. Together, our results indicate that ROR1/2 plays critical roles in the specification and patterning of several gene regulatory territories during early sea urchin embryonic development.

Title: What is the standard of evaluation for community pharmacist led health screening services? A systematic review

Primary Author: Brandy Davis

Additional Authors: Adelia Grabowsky;Natalie Hohmann;Brent Fox;Lindsey Hohmann;Ibrahim Alfayoumi;

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Community pharmacists are being asked to implement an increasing number of clinical screening services. However, little is known on how these implemented screening services are evaluated. The objective of this systematic review is to describe the standard of evaluation processes of clinical screening services implemented in community pharmacies. A systematic literature review was conducted. Articles were searched from the last 20 years in Ovid Medline, APA PsycINFO, Clinialtrials.gov, and International Pharmaceutical Abstracts. Inclusion criteria were written in English, described a community pharmacist led clinical or health-related screening service (e.g., depression screening), and evaluation of said health screening service was included. A total of 749 unique articles were identified. Three authors screened each title and abstract and then screened the full text articles for inclusion. Subsequent data extraction occurred which included elements of 1) description of screening service, 2) evaluation outcomes assessed, and 3) evaluation results. All elements of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist will be followed. The quality of included articles will be assessed using the Mixed Methods Appraisal Tool. Results are expected to show limited evaluation of screening services in pharmacies. Clinical conditions included in the screening services are expected to vary greatly. High quality evaluations will be noted as templates for future evaluation of screening services in community pharmacies. This systematic review will describe the current literature on evaluation of health screening services in community pharmacies. This will give readers an overview of how evaluations are currently being carried out in this setting, as well as provide them with templates of high quality evaluations for future evaluation of screening services.

Title: Comparison of scalable suspension-based manufacturing of engineered cardiac tissue hydrogel-supported microspheres and scaffold-free aggregates for scale-up production of cardiomyocytes

Primary Author: Brett Harvell

Additional Authors: Elizabeth Lipke;Selen Cremaschi;Shenbageshwaran Rajendiran;Mohammadjafar Hashemi;Shireen Singh;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Scalable suspension-based production of engineered heart tissue is necessary to meet the demand of cardiomyocytes. Here, we employed scalable production methods able to meet the demand to investigate the resulting cell types produced when differentiating hiPSCs in 3D hydrogel-supported engineered tissue microspheres (MS) versus widely used scaffold-free aggregates (Agg); we further compared their resulting functionality and CM yield. Human induced pluripotent stem cells (hiPSCs) have been differentiated in suspension culture for cardiomyocyte production; however, B27 differentiated MS and Agg platforms have not been directly compared and generated cell types have yet to be investigated. Briefly, dissociated hiPSCs were either encapsulated within a hydrogel using a microfluidic device to form MS or forcefully aggregated within a shaker flask to form Agg. HiPSCs were expanded for 3 days and, on differentiation day (DD) 0, the B27 cardiac differentiation protocol was performed. MS and Agg tissues show 60.7±27.9% and 47.8±30.1% number of cardiomyocytes respectively on differentiation day (DD) 10 using flow cytometry. On DD15, tissues were dissociated and analyzed using single cell RNA sequencing; a greater endodermal population was observed in Agg, whereas, MS showed a greater endothelial cell population, an important cell type for the formation of engineered cardiac tissues. Video-based contraction analysis on DD15 showed that MS cardiac tissues contract and relax at faster velocities compared to Agg; contraction and relaxation velocities were 81.6±4.0 µm/sec compared to aggregates with 38.9±22.4 µm/sec. Tissues were optically mapped on DD45 to evaluate electrophysiology; MS tissues were paced up to 3 Hz and show higher calcium conduction velocities and lower calcium transient durations compared to Agg paced up to 2 Hz. Overall, MS show higher functionality and CM yield than Agg and, therefore, are more advantageous for clinical scalable production.

Title: Evidence of the Importance of Nutrition Education for the Youth of Alabama

Primary Author: Briana Johnson

Additional Authors: Rita Fiagbor;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Nutrition education has a significant impact on children in the 9–13-year-old range, particularly in enhancing and creating their understanding the importance of healthy eating habits and kitchen safety. Camp CHEW (Cooking Healthy Eating Well) is a weeklong program conducted from 9am to 4pm Monday through Friday, aimed at educating 4th to 8th graders about nutrition, kitchen education, and cooking skills. At the start of the camp, each student was given a paper pre-test with the questions read out loud to gauge their knowledge before the start of camp. Throughout the week, students participated in various activities related to nutrition education and kitchen safety. At the end of the week, each participant took a post-test with the same questions to measure the camp's educational impact. The results indicated that the summer camp significantly improved participants' knowledge and confidence in the kitchen. The research showed that the camp had a positive impact on the participants' understanding of nutrition and kitchen safety, independent of their school education. Overall, Camp CHEW effectively enhanced the participants' knowledge and skills, contributing to their long-term health and well-being.

Title: Investigating the Impacts of Land Use on Soil Biogeochemistry in Headwater Wetlands in Baldwin County, Alabama

Primary Author: Brianna Travis

Additional Authors: Thorsten Knappenberger;Mary Ashlee Hughes;

Department/Program: AU National Resource Management and Development Institute

College: College of Forestry, Wildlife and Environment

Abstract: As the Gulf coast continues to develop, it has been shown that land use can increase stormwater runoff, reduce baseflow conditions, and lower water levels in receiving wetlands. Has the biogeochemistry of soils in headwater wetlands been altered due to surrounding land uses, such as agricultural and urban development? We are investigating the tendency for land use to make headwater wetland soils less anaerobic by using IRIS (Indicator of Reduction in Soils) tubes at eight sites in Baldwin County, Alabama. For each wetland sampling event, five IRIS tubes are coated with a layer of manganese-based paint and five with iron-based paint, and then inserted into the soil 50 cm deep. After three weeks, the loss of manganese and iron paint from the IRIS tubes is measured and used as an indication of anaerobic soils conditions. By quantifying the amount and depth of loss of manganese and iron , we will assess the tendency for wetland soils to sustain anaerobic conditions which is expected in reference wetlands. These results will help assess the potential hydrologic impacts that are related to surrounding land use. In wetlands with less impact from these developments, we expect more consistent anaerobic conditions. These conditions should cause a significant loss of these elements into solutions and, in turn, a high percent loss of IRIS tube paint. Periodic sampling of wetlands is conducted seasonally for one year (i.e., winter 2024). Initial IRIS tube measures indicated mixed results between wetlands and land uses, however year-long trends will be examined at the end of the one-year study. This project will enable us to examine 1) if the headwater wetland soils show signs of alteration and impacted conditions compared to reference conditions and 2) the seasonal changes in these headwater wetlands. We are expecting to see greater variability in IRIS tube results at wetland sites affected by agricultural and urban land use.

Title: Regulation of SWEET Sugar Transporters by Cytokinin and the role in Source-Sink Dynamics

Primary Author: Brianne Giglio

Additional Authors: Ashley Buchheit;Risheek Rahul Khanna;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Rising global population levels have increased the demand for crops with higher yield. Sugar transport is a fundamental process in plants that plays a crucial role in determining plant growth, development, metabolism, and eventually crop productivity. In plants, sugar movement follows a source-to-sink pattern, where active tissues, sources, supply sugars to actively growing tissues, sinks. The SWEET family of sugar transporter genes facilitate the movement of sugars across cellular membranes, critically influencing source-sink dynamics. Sugar transport can be regulated by plant hormones such as cytokinin (CK), but how this mechanism occurs is unknown. We used transcriptome (RNAseq) analysis to identify CK regulated sugar transporters and found SWEET11, 12, and 15 to be induced. While the SWEET family transports various sugars, SWEET11, 12, and 15 are sucrose specific transporters. For our study, we used SWEET mutant lines to analyze source/sink differences and CK effects on sugar transport. We tested growth differences in loss of function mutant SWEET lines using image based phenotyping in the model plant Arabidopsis thaliana. Additionally we evaluated tissue level expression of SWEETs using GUS reporter lines. SWEET mutants showed reductions in plant growth including rosette diameter and leaf size. Reporter line expression indicates SWEET11 and SWEET12 to be expressed majorly in vasculature while SWEET15 was restricted to floral buds.This study aims to further investigate sucrose and glucose accumulation, as well as source-sink tissue differences, following CK treatment. Findings from this work establish SWEET as transporters regulating sugar dynamics and its control by plant hormones. Considering the crucial role sugar transport plays in enhancing crop yield, knowledge from this work establishes targets for regulation of these processes - eventually helping identify regulatory mechanisms towards engineering higher yield plants with higher yield.

Title: Why stay in education in a post-COVID world?

Primary Author: Bridget Wingo

Additional Authors:

Department/Program: Educational FLT

College: College of Education

Abstract: The COVID-19 pandemic has profoundly impacted the field of education, leading to increased stress and burnout among teachers. This study explores the lived experiences of teachers who have remained in the profession despite these challenges. Using qualitative methods, we conducted semi-structured interviews with three teachers, each with over ten years of experience, to understand their motivations and the factors influencing their decision to stay. Our findings reveal three key themes: accountability, connection, and feeling valued. Teachers emphasized the need for accountability among students, parents, and the community to support educational outcomes. The importance of connection, both with colleagues and with students' families, emerged as a critical factor in maintaining teacher morale and commitment. Additionally, feeling valued and respected within the profession was highlighted as essential for teacher retention. This study provides valuable insights into the challenges and motivations of teachers in a post-COVID world. By understanding these factors, policymakers and educational leaders can develop strategies to support and retain teachers, ensuring a stable and effective educational workforce.

Title: Effects of Maternal Heat Stress on the Sex Ratio of Offspring

Primary Author: Brielle Hay

Additional Authors: Haruka Wada;Alex Hoffman;Kayci Messerly;Thalia Williamson;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: As temperatures rise animals struggle to cope, particularly for those who are unable to escape from the heat. Thus, understanding the mechanism behind how heat stress affects animals in all aspects helps us to better prepare to fight against the negative effects. Acquired tolerance is a process that allows heat tolerance to be passed on to the next generation. We hypothesize that heat stress during juvenile stages will increase heat tolerance of their embryo offspring; and that heat stress during the incubation period will lead to a higher mortality rate of female zebra finch embryos than male embryos; since female zebra finches are more vulnerable to the stresses of changes. To test this, zebra finches (Taeniopygia castanotis) went through a 2 x 2 factorial design experiment. Juvenile females were initially either exposed to a mild heat stressor (38 °C for 28 days) or maintained at their housing temperature in the brooder at 21-23 °C. Then as adults, females were either exposed to 42 °C for 3 days or housed in the brooders at 21-23 °C. Eggs laid by those females were then exposed to either optimal or high incubation temperatures. If heat tolerance is a heritable thing then this could be a solution to protecting species from increasing temperatures. After collection and analysis of data it was found that maternal treatments had no effect on the sex ratio of embryos. This reveals that acquired tolerance does not aid in protection of embryos or influence the sex ratio, meaning that males and females are affected equally. Next step would be to use this data to better understand how heat affects embryos and why there is no evidence of higher mortality in female embryos.

Title: Adverse childhood experiences, adolescent individual differences, and mental health: A developmental cascade model

Primary Author: Bruno Ache Akua

Additional Authors: Diana Samek;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Adolescent alcohol use, anxiety and depressive symptoms, and sleep deficits remain prevalent. Informed by the bioecological theory and developmental psychopathology framework, this study sought to explore the developmental cascade of how individual difference factors of impulsivity and emotion dysregulation at ages 12 and 13 helped to explain the association between adverse childhood experiences (ACEs) at age 10 and adolescent alcohol use, depression/anxiety symptoms, and sleep quality 4 years later (age 14). This was evaluated by employing secondary analysis of the ABCD Study of adolescents who completed the Wave 5 assessment ($N = 4,616$; data release 5.1). A structural equation model was used to fit the data. The model included baseline covariates of impulsivity, alcohol use, sleep, and race/ethnicity. Wave 5 outcomes were residually correlated. Emotion dysregulation was measured as a latent variable with 3 scale indicators. All other variables were manifest. Preliminary analyses revealed a significant direct association between ACEs at baseline and poor sleep quality 4 years later ($\beta = .06$, $p < .001$). There were no direct effects between ACEs and alcohol use ($\beta = .03$, $p = .37$) or internalizing symptoms ($\beta = .02$, $p = .42$). Alcohol use at baseline also predicted sleep deficits ($\beta = .03$, $p = .02$) 4 years later. Further, Wave 3 impulsivity predicted Wave 4 emotion dysregulation ($\beta = .14$, $p < .001$). The indirect effect model demonstrated a good fit on all fit indices (CFI = .97; SRMR = .02; RMSEA = .05, 90% CI: .047, .056). There was a significant indirect effect of emotion dysregulation linking the association between ACEs and poor sleep quality ($\beta = .02$, 95% CI: .01, .02); the direct effect of ACEs on poor sleep was partially but not fully explained ($\beta = .05$, 95% C1: .01, .02). Results are expected to help highlight multiple entry points to disrupt this cascade and promote adolescent health and well-being.

Title: Advancing DNA-based data storage: Exploring ssDNA interaction with 2D nanomaterials through molecular dynamics simulations

Primary Author: Bruno Henrique Lisenko Ribeiro

Additional Authors: Marcelo Kuroda;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Reliable data storage is in higher demand than ever, and this need is expected to grow exponentially in the next decade. With rapid advancements in AI and the growing digital landscape, the demand for long-term, reliable data storage is increasing significantly. Currently, magnetic tape is the only available long-term data storage method, but it has numerous limitations. A promising alternative is DNA-based data storage, which has a half-life exceeding 500 years and can be read significantly more times than magnetic tape before data degradation occurs. A major bottleneck, however, is the reliable reading of data encoded in DNA molecules. Recent studies suggest that 2D materials can stabilize and facilitate the reading of ssDNA molecules. To assess the feasibility of using ssDNA as a storage medium, we conducted Molecular Dynamics (MD) simulations on various surface designs featuring hexagonal boron nitride and graphene. Our results reveal differences in interactions between ssDNA and each material, as well as how biomolecule manipulation on a potential reading device can be achieved using an electric field.

Title: Elevated obesity rates among male students at Auburn University: a localized health concern exceeding national trends

Primary Author: Bucky Moore

Additional Authors: Onikia Brown;Rita Fiagbor;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Obesity is associated with numerous health risks, including diabetes, hypertension, and hyperlipidemia, and is particularly prevalent in the southeastern United States. While college-aged males have historically exhibited lower obesity rates than other populations, a secondary analysis of data from male students at Auburn University was conducted to explore whether this trend holds true within a localized setting. Male students were chosen as the focus due to their unique dietary and lifestyle patterns, which may contribute to differences in obesity prevalence compared to female students. Statistical analyses, including the Student's t-test, indicate that the prevalence of overweight and obesity in this population exceeds the national average by approximately three standard deviations, highlighting a significant deviation from expected trends. Initially, food insecurity was investigated as a potential contributing factor; however, no significant association was found. In future studies, we plan to examine alternative contributors, such as physical activity levels, dietary habits, and metabolic health indicators, to identify the primary drivers of this trend. Understanding the factors behind this elevated obesity prevalence is critical for developing targeted interventions that promote student health and well-being, ultimately reducing the chronic health consequences of obesity-related diseases.

Title: OCEAN GENES: DISCOVERING SUBSTRATES FOR MEMBRANE TRANSPORTERS IN RUEGERIA POMEROYI

Primary Author: Caje Naranjo

Additional Authors: Maria Florencia Breitman; Mary Ann Moran; William Schroer; Jeremy Schreier; Madeline Kriston Shepard; McKenzie Powers; Erin Dolan; Victoria Centurino; Anjelica Valencia; Gabriel Rissman; Khushali Bharatbhai Panchal; Romeria Martin; Sarah Folmar; Alexze DeJarnett; Kelly Corbin; Paige Blankenship;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Carbon is the foundation of all organic molecules and plays a crucial role in climate change. Carbon can be incorporated into biomass, sedimented at the bottom of the ocean, or in the atmosphere as CO2, making the Earth warmer along with other greenhouse gasses. Studying the oceans is crucial because that's where half of the Earth's photosynthesis happens. In particular, studying ocean bacteria is extremely important because they drive key steps in the carbon cycle. The bacteria Ruegeria pomeroyi is emerging as a model organism for understanding carbon flux in the ocean. Ruegeria pomeroyi has a published genome and is easy to grow in the lab; colleagues from UGA have been researching this organism for +20 years and have developed ~4000 lines of mutants along with lab protocols for the discovery of genes that regulate metabolite uptake. In this work we describe the results of a Course-based Undergraduate Research Experience that was conducted in Spring 2025 at Auburn University at Montgomery. In this study, we grew ~ 20 mutant R. pomeroyi bacteria with unique disruptions in transporter genes for which the substrate taken up by the transporter is unknown on various substrates. We performed t-tests to understand if growth was significantly different, and we discussed results in light of the available literature.

Title: Liver regeneration through transient yes-associated protein 1 YAP activation mediated by Jade3

Primary Author: Caleah Williams

Additional Authors: Karel Alcedo;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Transient activation of Yes-associated protein 1 (YAP) is essential for liver regeneration, while its constitutive activation promotes tumorigenesis. Although the role of sustained YAP activation has been extensively studied, the mechanisms and consequences of its transient activation remain poorly understood. We previously reported using an inducible YAP mouse model that transient YAP activation triggers an enduring adaptive response through transcriptional and epigenetic reprogramming. Here, we identify Jade3, a chromatin remodeling scaffold protein, as a persistently expressed factor following YAP inactivation. Through biochemical analyses, we found that H4K5 acetylation levels remain elevated in both YAP-activated and post-inactivation states compared to control. The known interaction of Jade3 with Tead transcription factors, established YAP binding partners during regeneration, together with our findings suggest that Jade3 may serve as a key mediator of transient YAP-induced transcriptional and epigenetic reprogramming. This work provides new insights into the molecular mechanisms governing liver regeneration and disease.

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

Primary Author: Callum Newberry

Additional Authors: Jennifer Fenner;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Wnt signaling drives germ layer (endoderm, mesoderm, and ectoderm) specification and patterning 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, but 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 did not form. These results suggest that all three molecules are necessary for embryogenesis but may be involved in different Wnt pathways. We used insitu 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: Mechanical Properties of Self-folding Polymer Miura Ori

Primary Author: Cameron Cohen

Additional Authors: Evelyn Squires;Russell Mailen;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Large space structures enable the next generation of space exploration, but launching these large structures to orbit is challenging and expensive. This has been mitigated to a small degree by using folding or telescoping metal-based structures, but these approaches add weight and complexity with motors and other actuators. Origami presents a promising solution through its ability to form complex shapes from thin, flexible, lightweight sheets with limited added complexity. Herein, we propose to research the feasibility of using self-folding Miura Ori in space environments for generating pre-defined geometries. Miura Ori is a form of origami that uses a repeated parallelogram unit cell fold pattern to form quasi-smooth 2D or 3D surfaces. We have demonstrated the use of Shape Memory Polymers (SMPs) and localized heating to autonomously activate and control folding of thin sheets. For this we use sheets of clear pre-strained polystyrene as the SMP. We pattern sheets of SMPs on the top and bottom surface using a CNC machine holding a marker. Then, we pre-heat the SMPs close to the Glass Transition Temperature (Tg) with a hot plate and shine infrared (IR) lights to heat the marked regions above Tg. To better understand the use of SMP Miura Ori for forming large space structures, we aim to understand the mechanical properties of self-folded Miura Ori. We will determine the dependence of the final strength and stiffness of the shape on the unit cell size and shape, hinge line thickness, preheating temperature, and the time to fold the sample. We will measure each folded sample's mechanical properties, with tension, compression, and bending tests. This research will allow us to advance the Technology Readiness Levels of SMPs set for self-folding Miura Ori for space applications, opening the gateway to forming more complex, lightweight space structures where the form is inherent to the function (i.e., telescopes, drag devices, solar arrays).

Title: A survey of the clinical usage of non-steroidal intra-articular therapeutics in dogs by veterinary practitioners

Primary Author: Camila Paz Sepulveda Ansaldo

Additional Authors: Kayla Olson Corriveau;Anne Wooldridge;Kara Lascola;Maggie Kane;Erik Hofmeister;Lindsey Boone;

Department/Program: Clinical Sciences

College: College of Veterinary Medicine

Abstract: Osteoarthritis (OA) is a degenerative condition of the joint, whose progressive characteristics can lead to significant functional impairment and pain in the canine patient. Interest has increased regarding the use of non-steroidal intra-articular therapeutics (NSIATs) as part of the multimodal management of canine OA. This study aims to know the clinical experience of practitioners using these therapeutics to better understand their clinical usage, perceived outcomes, and clinical reasoning for product usage. A survey inquiring about intra-articular (IA) injections and the use of NSIATs including platelet-rich plasma (PRP), autologous conditioned serum (ACS), autologous protein solution (APS), cellular therapy, viscosupplements, and radionuclides was distributed to canine practitioners. A total of 174 surveys were included in the results. Intra-articular injections were performed by 164 participants. Among these, 144 practitioners used NSIATs. The most common joint injected with steroidal and/or NSIATs was the elbow. The top reason for participants' decision as to which NSIATs they preferentially used was scientific data and articles published regarding the product’s safety and efficacy. The most commonly used NSIATs were PRP and viscosupplements, followed by cellular therapy, radionuclides, ACS, and APS. Practitioners reported that the most common reason to use PRP and viscosupplements was chronic articular pathology needing ‘maintenance’ or routine injections. Most participants did not combine PRP with other IA therapeutics. In the case of viscosupplements, it was usually combined with corticosteroids. According to the participant's subjective assessment, most of the positive responders presented some or substantial clinical improvement after PRP or viscosupplements administration. This is the first survey on this topic conducted in the field of small animal studies. These results provide valuable insights into the use of non-steroidal joint therapy in canines.

Title: Role of hepatocyte inflammation in colorectal cancer

Primary Author: Campbell Jernigan

Additional Authors: Michael Greene;Kathryn Edmondson;Ifeoluwa Odeniyi;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: The incidence of obesity, and in turn chronic disease, is ever increasing in the US. As such, this study finds it pertinent to evaluate the link between the inflammation of hepatocytes and the proliferation of colorectal cancer (CRC). Whereas previous studies focused on obesity-linked adipose tissue dysfunction and its connection to CRC; the liver is being evaluated because it is a key source of inflammatory molecules in obesity, which are hypothesized to play a role in stimulating CRC. One group of hepatocytes (insulin resistant) are to be treated with inflammatory proteins to mimic obesity and will be incubated in hypoxic environment to induce insulin resistance. Another group of hepatocytes (insulin sensitive) will be left untreated. HT-29 and CL-40 cells (two human CRC lines) will be used in the creation of an engineered tissue made up of fibrinogen with a hydrogel matrix to mimic the malleable properties of a tumor. The tissues will be subjected to conditioned medias from the hepatocyte groups to track the rate of CRC proliferation and movement of the cells out of the tissue. Results from this study will be used to identify new targets for therapeutics to treat obesity-linked CRC.

Title: Production and Properties of Hand sheets from Food Waste

Primary Author: Camylle Lollar

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: In the United States, 72.5 billion kg of waste is produced annually, with 9.9 to 15 billion kg coming specifically from restaurants. 45% of food waste is made up of fruits and vegetables that are thrown into landfills. Food waste in landfills can take anywhere from a few weeks to several years to decompose. During decomposition, food waste releases methane (CH4), a potent greenhouse gas. Conversely, restaurant food waste can become viable feedstocks; most notably cellulose, a versatile biopolymer. A particular type of food waste was processed through various methods to extract both cellulose and lignin which was then further processed to form industry standard hand sheets; one of the various products that can be produced from this abundant biopolymer.

Title: Sexual Dimorphism of the Glucose Transporter GLUT1 in THC Exposed Rat Placentas

Primary Author: Carly Parker

Additional Authors: Rachel West;Miranda Reed;Adrian Courville;Cristine Camp;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: With the rise in marijuana use, there has been a corresponding increase in prenatal exposure to cannabinoids. Prenatal tetrahydrocannabinol (THC) exposure has been linked to low birth weight; however, it is unclear if THC affects male and female fetuses differently. During pregnancy, the glucose transporter protein, GLUT1, plays a vital role in transplacental glucose transport and altered levels can lead to preeclampsia and fetal growth restriction. Our study aims to investigate if prenatal cannabinoid exposure has a sexually dimorphic effect on GLUT1 protein. Starting at gestational day (GD) 5, pregnant rats were exposed to 100 mg/mL of vaporized THC or polyethylene glycol (PEG). Rats were sacrificed on GD 19 and placentas were collected. We next performed Western blotting to detect protein levels of GLUT1. The concentration of GLUT1 proteins were normalized using glyceraldehyde 3 phosphate dehydrogenase (GAPDH) as a relative density standard. In both PEG and THC-exposed placentas, a statistically significant difference in GLUT1 protein levels was observed between male and female placentas ($p < 0.05$). However, there were no significant differences in GLUT1 levels when comparing PEG female placental weights to THC-exposed female placental weights, or between PEG male placentas and THC-exposed male placentas. While there is significant sexual dimorphism in GLUT1 protein levels between male and female placentas in both vehicle and THC-exposed groups, the administration of THC does not significantly alter GLUT1 protein compared to vehicle controls. In the comparison of male PEG placentas versus THC-exposed placentas, there is an observable but not significant.

Title: Characterizing the pathogenicity of V. diazotrophicus in vivo utilizing the expression of fluorescent proteins

Primary Author: Carly Thatcher

Additional Authors: Jake Tatum;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Vibrio species are a diverse heterotrophic group of Gram-negative bacteria that are common pathogens of marine invertebrates, specifically the larval and adult forms of the purple sea urchin (Strongylocentrotus purpuratus). Sea urchins, provide a unique model system to study immune responses. As invertebrate deuterostomes, sea urchins share important genetic and developmental similarities with vertebrates but are morphologically simple and transparent. Larvae are filter feeders with an open gut system that leaves them vulnerable to infection from marine bacteria. The larval immune response relays complex interactions among pattern recognition receptors (e.g., Toll-like receptors [TLRs] and Nod-like receptors [NLRs]) that activate the immune response. This is characterized by inflammation of the gut epithelium, rapid production of the cytokine IL-17 and immune cell migration. In situ hybridization reveals that V. diazotrophicus can effectively colonize the larval gut and subsequently invade the blastocoel, although this infection is non-lethal and invading bacteria are cleared by an unknown population of phagocytes. To identify these cells that mediate clearance, we employed a novel strategy that relies on heterologous expression of two fluorescent proteins: GFP (which is degraded in phagolysosomes) and RFP (which is resistant to lysosomal degradation). As a first step in this process, we have generated replicative plasmids in which the expression of these fluorescent proteins is regulated by eight distinct Vibrio promoters. qPCR data indicate that, of the eight promoters tested, rpoD and gyrB promoters resulted in the highest in vivo expression levels. Vibrio strains harboring these plasmids will be used to infect sea urchin larvae and quantify phagocytic behavior. This work represents the first characterization of Vibrio infection using in vivo microscopy and will help to characterize the innate immune responses of this emerging host-microbe model.

Title: Exploring the effects of burn heterogeneity, mechanical soil disturbance, and seed addition in restoring a long-unburned shortleaf pine woodland ecosystem

Primary Author: Caroline Crews

Additional Authors: Timothy Shearman;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Fire-dependent open savanna and woodland ecosystems were once prevalent in the southeastern U.S. However, fire suppression has led to their decline, resulting in closed-canopy forests with diminished diversity. Restoration efforts following prolonged fire exclusion aim to reestablish the rich ground layer diversity, open canopy, and frequent fire regime that characterize these ecosystems and generally employ a combination of prescribed fire, canopy thinning, midstory control, and native seed planting. However, research on the effectiveness of these strategies in restoring the herbaceous layer remains limited, particularly in shortleaf pine (Pinus echinata) woodlands. Understory regeneration during restoration can be hindered by a variety of factors, including seed or propagule limitation, soil compaction and disturbance, burn heterogeneity, competition from resprouting hardwoods, and light availability. Our study aims to disentangle the factors that limit or promote understory response during the initial phases of restoration. Taking advantage of a long-term fire exclusion experiment at Tall Timbers Research Station in the Red Hills region of northern Florida, we will monitor vegetation response to prescribed fire reintroduction, canopy thinning, mechanical soil disturbance, and native seed addition during the initial phases of woodland restoration. This poster will highlight the current condition of NB66 and the proposed restoration treatments, study design, and expected outcomes. Ultimately, we aim to provide actionable insights that land managers can use to effectively restore biodiversity and ecological resilience in long-unburned, remnant shortleaf pine woodlands.

Title: Influence of ball scaling on pitching kinetics in youth baseball: A pilot study.

Primary Author: Caroline Keller

Additional Authors: Gretchen Oliver;Anthony Fava;Billy Lozowski;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Upper-extremity injuries are prevalent in youth baseball, especially between 9-12 years old. Pitch count is often used to manage workload; however, recent research has demonstrated that adjusting ball size may be a practical solution too. While this approach is promising, consideration must also be given to player-specific characteristics (e.g. hand size). Therefore, the purpose of this study was to explore how upper-extremity kinetics in youth baseball differ when using scaled baseballs. Kinematic data (240 Hz) was collected for 13 youth baseball pitchers (11 ± 1y; 1.42 ± 0.12m; 45.3 ± 14.1kg), and kinetics were then calculated from kinematic data. Each pitcher threw 15 game-intensity fastballs from regulation distance toward a strike zone. Five pitches were thrown with a standard leather baseball (Reg), five with a 3D-printed ball that was the same size and weight as a standard baseball (ST), and five with a 3D-printed ball scaled to the average hand size of the age group (SC). Dependent variables were peak passive shoulder rotation (SR), shoulder horizontal adduction (SHA), and elbow varus (EV) torques. Data processing and statistical analysis were performed in R Studio (Posit PBC, Boston, MA). SHA torque was negatively skewed; however, the Jarque-Bera test of normality determined that there wasn't a sufficient deviation from a normal distribution (JB = 1.36, p = .50). Assumptions of homoscedasticity were violated for EV torque, so a robust standard errors correction was applied. Results indicated that while torques were generally lower for the SC compared to ST and Reg balls, torques were not statistically different in either age group (all ps > .05). No consistent differences were observed between balls on a throw-by-throw basis, suggesting that upper-extremity kinetics cannot be reduced by using a smaller, lighter ball. However, advantages regarding cumulative load (e.g. work over multiple throws) could benefit younger players, particularly at 9-10 years old.

Title: Semi-quantitative analysis of the MSK1 and STK11 genes in canine mammary cancer

Primary Author: Caroline Parrish

Additional Authors: Deepika Goyal;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: MSK1 and STK11 are key regulatory genes in the signal transduction cascade controlling cell proliferation in cancer cells. The open reading frames of the genes encoding MSK1 and STK11 expressed in mammary cancers of domestic dogs, Canis lupus familiaris, were analyzed to find highly conserved sequences for designing a semi-quatitative PCR reaction that can specifically amplify the targeted region of each of the coding sequences, as well as using gel electrophoresis and sequencing to verify the results. MSK1 and STK11's genomic sequences that are found in canis lupus familiaris allow us to use them as a model organism to understand breast cancer in humans (Homo sapiens), as these same sequences are found in humans. To optimize the PCR protocol for amplifying the targeted sequences, first, rtPCR primers were created by using the genomic sequences of the MSK1 and STK11 genes in Canis lupus familiaris. The next step was culturing of Canius lupus familiaris mammary tumor cell lines to extract a high-quality amount of RNA that is needed for the rtPCR reaction. The rtPCR protocol was optimized by analyzing the amount of RNA and $MgSO_4$ added to each reaction. The samples were then purified from the PCR amplicons, and then were sent off for Sanger Sequencing. The results were then analyzed using the Chromas software which looks at the flat files of the base pairs, ensuring accurate results and correct sequencing verification. Once verified, semi-quantitative analysis was performed to see what the levels of expression would look like. The best set of primers from each gene, MSK1 and STK11, were chosen for the semi-quantitative analysis. By changing the levels of RNA, it will allow us to assess what the tumor expression will look like, which will let us look at the specific amplification of the target sequences encoding MSK1 and STK11, and can then be used for further analysis against different canine mammary cell lines to observe their expression and tumor promoting characteristics.

Title: Cultivating living infrastructure in the historic Greenwood district in Tulsa, Oklahoma

Primary Author: Caroline Purdy

Additional Authors:

Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: The Tulsa Race Massacre of 1921 decimated the thriving Black Wall Street community in Greenwood, Tulsa, leaving a legacy of racial trauma and urban displacement. Today, minority communities continue to bear the burden of environmental injustices, such as inequitable access to greenspaces—studies indicate they enjoy one-third less park access than white citizens. This project proposes a detailed design for a 34-acre community greenspace along historic Greenwood Street, integrating restorative justice with targeted design interventions that remediate environmental disparities. By incorporating specific features—including permeable surfaces, native vegetation buffers, and stormwater management systems—the design directly addresses environmental injustice while enhancing urban ecology. Community input, garnered through extensive public consultations and participatory workshops, has shaped design decisions from the ground up, ensuring that cultural values and local needs are embedded throughout the planning process. To mitigate gentrification, the project employs strategies such as affordable community programming, long-term land trusts, and partnership with local organizations, with measurable outcomes including increased greenspace accessibility, improved air quality, and community-led stewardship initiatives. Central to the design is the "living infrastructure" concept, which frames the space as an evolving ecosystem that supports both natural processes and cultural narratives. Historical commemoration is achieved through concrete installations like memorial gardens, interpretive trails featuring oral histories and archival displays, and cultural commons that host community events. Through rigorous site analysis and comprehensive community needs assessments, this multifunctional public space honors the past and envisions a vibrant, inclusive future, contributing to broader discourses on culturally sensitive memorial landscapes that resist displacement while bolstering community identity and ecological health.

Title: The effects of Phosphoprotein Enriched in Astrocytes-15 (PEA15) on metabolism and gene expression of regulators of the central and peripheral clock.

Primary Author: Carrie Smith

Additional Authors: Emily Graff;Angela Vines;Ifeoluwa Odeniyi;Michael Green;Rie Watanabe;Taylor Towns;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Phosphoprotein Enriched in Astrocytes-15 (PEA15) is a key regulator in the mitogen-activated protein kinase (MAPK)/extracellular signal-regulated kinase (ERK) pathway. The MAPK/ERK pathway plays a critical role in the timing of the suprachiasmatic nucleus (SCN) of the hypothalamus, which is central to circadian rhythm timing. Circadian rhythm regulates many behaviors, such as sleep-wake cycles, food intake, and metabolic flexibility, and disruptions in the circadian rhythm have profound health consequences. Previous studies in our lab demonstrated that mice fed a high-fat diet (HFD) have increased pea15 expression in the hypothalamus, and pea15-/- mice have sex-specific changes in metabolic flexibility. Based on these findings, we hypothesized that PEA15 loss of function disrupts central and peripheral tissue circadian rhythm contributing to changes in metabolic flexibility. To test this hypothesis, total RNA was isolated from the hypothalamus, liver, and adipose tissue of male and female mice under the following treatment conditions: chow wild type (WT), chow knockout (KO), HFD WT, and HFD KO. The RNA was converted to cDNA and customized gene array panels were used to determine changes in 7 key regulators of circadian rhythm (Cry1, Cry2, Per1, Per2, Per3, Clock, ARNTL,). In the central clock tissue (hypothalamus), minimal changes were seen in the gene expression ratios. In the peripheral clock tissues (liver and adipose), changes in the gene expression ratios were noted based on genotype and sex. In conclusion, the metabolic effects of pea15 likely impact the peripheral clock of circadian rhythm, which is supported by the varying expression of pea15 seen in these tissues. Further studies would include a deeper analysis of the specific clock genes that are impacted by pea15 expression. This research would provide a greater understanding of the role of PEA15 in circadian rhythm and metabolic flexibility, contributing to its role in metabolic diseases of animals.

Title: Behavioral Effects of Developmental Exposure to the Trichloroethylene Metabolite TCOH in Zebrafish

Primary Author: Carson Moore

Additional Authors: Maryam Hariri;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Trichloroethylene (TCE) is a volatile organic compound (VOC) that has historically been utilized as a solvent for grease removal on industrial equipment. Trichloroethylene (TCE) has been linked to several health effects including neurotoxicity, developmental defects, organ toxicity, and carcinogenicity. Traces of this compound have been discovered in surface and underground water reservoirs as well as many superfund sites within the United States. Many of the carcinogenic and detrimental health effects of TCE are derived from its many metabolites. Due to its various health concerns, the Environmental Protection Agency has set a maximum contaminant level of 5 parts per billion (ppb; µg/L) for trichloroethylene in drinking water. This study will evaluate the hypothesis that TCOH (2,2,2-trichloroethanol), a phase I oxidative pathway (P450) derived metabolite of TCE, contributes to behavioral alterations in zebrafish (Danio rerio) with developmental TCE exposure. In this study, zebrafish embryos were dosed immediately after fertilization with 0, 5, 50, or 500 ppb of TCOH. Behavior assays were performed at 120 hours post fertilization (hpf). The Noldus DanioVision Observation Chamber was utilized to undergo a visual-motor response test in order to obtain relevant behavioral results. Although there were no significant results for behavior endpoints such as heading, turn angle, angular velocity, and meander values, there were significant, dose dependent decreases in parameters such as total distance moved, velocity, time moving, time not moving, frequency clockwise (CW) rotation, and frequency counter-clockwise (CCW) rotation in the 50 and 500 ppb exposure groups compared to the control group. The results suggest a dose-response relationship where TCOH does contribute to TCE associated developmental toxicity. (Character count: 1,833)

Title: Spectral signature analysis for rapid, non-destructive diagnosis of pest-induced stress in strawberries

Primary Author: Carter Freeman

Additional Authors: Tanzeel Rehman;Sushan Ru;Md Hasibur Rahman;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Pest infestations in strawberry cultivation have become a significant concern for crop management, particularly as farming practices intensify and environmental conditions fluctuate. Strawberries are a high-value crop, and even minor losses in yield can have substantial economic impacts for growers and supply chains. Early and accurate detection of pests is essential to minimize damage and optimize intervention strategies. Conventional manual scouting is both time-consuming and labor-intensive. This limitation often results in delayed detection of pest outbreaks, allowing infestations to progress unchecked. Among the most problematic pests are the two-spotted spider mite (Tetranychus urticae) and aphids (family Aphididae), which can severely impair plant health, reduce yield, and compromise fruit quality. Spectral reflectance is a critical tool in this context, as it reveals key biophysical and biochemical properties of plant tissues by capturing subtle physiological changes. Spectral signature analysis offers a reliable means to detect early pest-induced stress that might be missed during manual scouting. This study aims to develop a rapid, non-destructive pest classification method using spectral data from four strawberry cultivars (genus Fragaria). Spectral signatures of strawberry leaves will be acquired using a FieldSpec spectroradiometer, covering the spectral range of 400 nm to 2500 nm. To distinguish between healthy and pest-infested plants, statistical-based models (Partial Least Squares Regression and Support Vector Machines) will be employed. These models will be trained and validated using the collected spectral reflectance data to accurately classify pest presence. The use of these spectral data models is expected to deliver an efficient diagnostic tool, providing farmers with timely and precise information on pest infestations and facilitating prompt, effective pest management decisions.

Title: Writing Wrongs: A Clinical Trial of Adapted Expressive Writing for Minoritized Students at Predominantly White Institutions Facing Microaggressions

Primary Author: Cassidy Chesnutt

Additional Authors: Tracy Witte;Hailey Fox;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Racial and ethnic based stressors, such as microaggressions, compound upon universally experienced stressors of higher education can result in lasting negative repercussions for minoritized students enrolled at Predominantly White Institutions (PWIs). Negative repercussions of microaggressions include increased dropout or transfer rates, distress, fatigue resulting in decreased academic performance, and depression and posttraumatic stress symptoms. Expressive writing (EW) may be a scalable intervention for addressing the negative repercussions resulting from microaggressions given previous research suggests that EW for stressful life events results in benefits such as reduced depression and posttraumatic stress symptoms, improved coping strategies, and reduced activity restriction. Informed by the ADAPT-ITT model, our research group previously conducted a pilot study to adapt EW to specifically address microaggressions experienced by minoritized students. This pilot study demonstrated the acceptability of an adapted version of the EW titled Writing Wrongs, as well as recommended future modifications for Writing Wrongs. In the current study, 70 minoritized students attending a PWI were enrolled in a randomized-controlled trial to establish the efficacy of Writing Wrongs in alleviating clinical symptoms. We hypothesize that those assigned to the treatment condition (n = 35), completing the Writing Wrongs activity, will demonstrate an improvement in symptoms of racial and discriminatory trauma, depression, anxiety, and posttraumatic stress over time and compared to those assigned to the assessment-only condition (n = 35). If found to be efficacious, Writing Wrongs has the potential to be widely disseminated to minoritized college students who experience microaggressions.

Title: Self-folding shape memory polymer origami activated by joule heating of additively manufactured conductive filaments

Primary Author: Chandler Livingston

Additional Authors: Russell Mailen;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Shape memory polymers (SMPs) are smart materials with the ability to change shape in response to the application of an external stimulus, such as heat or light. SMPs have been used as actuators for self-folding origami, wherein exposing polystyrene samples marked with permanent ink patterns to infrared (IR) light induces localized heating and folding. This approach has demonstrated self-folding but is limited due to the need for an external light source. Furthermore, inconsistencies in the light source can reduce the accuracy of the self-folding. An alternative activation mechanism is joule heating, in which an electrical current applied to a conductive filament induces heating and folding. In past research, joule heating has been accomplished using an external heating patch, adding complexity and interfacing issues. In the present work, we investigate the self-folding of SMP samples using the joule heating in additively manufactured conductive filaments. The conductive filament was 3D-printed on the surface of an unstrained SMP. Then the sample was pre-strained using prescribed thermal and mechanical loads. The unstrained SMP used was polyethylene terephthalate glycol (PETG), and commercially available PETG and thermoplastic polyurethane (TPU) were used for the conductive filaments. The width of the printed path and the voltage were varied. The performance of the SMP was evaluated in terms of the angle folded, folding rate, and the temperature distribution across the sample. The angle folded by the SMP sample was determined using an edge detection algorithm. An IR thermal camera was used to measure temperature distribution. The use of conductive filament additively manufactured as an integral part of the sample eliminates the previously mentioned issues and allows for complex geometries not possible with standard manufacturing techniques. This approach allows for the rapid manufacturing of more complex actuators, as well as the manufacturing of these actuators on-demand in space.

Title: Exploiting Price Gaps in U.S. Government Bonds: A Gap Investment Strategy Following Monetary Policy Announcements

Primary Author: Chang Wook Ahn

Additional Authors: Hyunwoo Lee;Seungheon Kim;Seungtae Kim;

Department/Program: Business Administration

College: Harbert College of Business

Abstract: U.S. government bonds are traditionally viewed as safe-haven assets. However, following key U.S. monetary policy announcements, these securities often exhibit short-term pricing inefficiencies—known as price gaps—that present unique trading opportunities. This study explores the viability of a gap investment strategy that exploits these temporary mispricings in U.S. government bonds to generate consistent, risk-adjusted returns. The research establishes baseline yield ranges by analyzing historical data on U.S. Treasury yields and market reactions surrounding Federal Reserve policy events. It identifies significant deviations that signal potential entry and exit points for gap investments. The methodology employs event study analysis combined with simulation and backtesting techniques to assess the performance of this strategy. In particular, the study integrates risk management tools, such as predetermined stop-loss levels and dynamic portfolio adjustments, to mitigate potential adverse outcomes during volatile periods. Preliminary results indicate that the gap investment strategy can capture predictable short-term corrections in bond prices, leading to improved risk-adjusted returns compared to traditional buy-and-hold approaches. The findings suggest that, when executed under carefully defined conditions, gap investments offer a scalable and practical approach for institutional and risk-averse investors aiming to enhance yield stability without substantially increasing exposure to market volatility. This research contributes to the existing literature by bridging the effects of monetary policy on bond pricing with tactical investment strategies. The proposed framework provides valuable, actionable strategies for practitioners seeking to leverage market inefficiencies in an evolving financial landscape.

Title: A Manganese Complex with a Fluxional Bipyridine Backbone Ligand for Multi-Electron Energy Storage in RFBs

Primary Author: Charles Daramola

Additional Authors: Byron Farnum;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: ABSTRACT A Manganese Complex with a Fluxional Bipyridine Backbone Ligand for Multi-Electron Energy Storage in RFBs The critical need for highly stable and efficient redox active organometallic compounds for energy storage is increasing, particularly for redox flow batteries (RFBs), which store excess energy from renewable sources such as solar and wind. This research focuses on first-row coordination compounds. The manganese bipyridine complex featuring a benzylic diethylamine group strategically positioned in the secondary coordination sphere acts as a fluxional ligand investigated for its structural adaptability during redox cycling. This complex transitions through intermediate oxidation states, from Mn+I to Mn-I, leveraging disproportionation to allow a robust 2e- redox couple governed by metal-ligand bond formation as observed by cyclic voltammetry. This 2e- redox cycle offers a promising pathway for optimizing energy storage systems.

Title: TIKI1/2 is required for anterior-posterior axis specification and patterning in sea urchin embryos

Primary Author: Cheikhouna Ka

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Three different, yet interconnected Wnt pathways govern anterior/posterior (A/P) axis specification and patterning during early sea urchin embryogenesis. Previous studies suggest that secreted and membrane-bound modulators play critical roles in regulating embryonic Wnt signaling in multiple organisms. Specifically, in vertebrates, the novel, Wnt-specific metalloprotease known as TIKI was shown to regulate A/P axis patterning. In this study, we describe how TIKI1/2 is integrated into the A/P Wnt signaling network in sea urchin embryos. Expression analyses indicate that maternal-and-later-zygotically expressed tiki1/2 transcripts are distributed broadly during cleavage stages and then dynamically expressed throughout the rest of embryogenesis. Interestingly, tiki1/2 is co-expressed with specific Wnt-signaling components including fzd5/8, sfrp1/5-like, sfrp3/4, and wif1, forming a complex, Wnt-signaling modulation environment that precisely governs the position of the anterior neuroectoderm (ANE) along the A/P axis. Functional perturbations using Morpholino antisense oligonucleotides, overexpression, and epistasis experiments demonstrate that TIKI1/2 is critical for patterning of the embryo along the A/P axis. TIKI1/2 morphants exhibited a radialized, exogastrulated phenotype that failed to form a skeleton. To better understand how TIKI1/2 is affecting specific GRNs along the A/P axis, we accessed the expression of key factors using whole-mount in situ hybridization. We found that disturbing TIKI1/2 function resulted in sever miss-expression of GRN factors, including cardinal transcription factors nodal and other TGF-beta signaling molecules. We also found that TIKI1/2 is required for proper sizing of the anterior neuroectoderm, likely through antagonism of the Wnt8-Fzd5/8-JNK signaling pathway. Furthermore, our functional analyses indicated that Fzd5/8 is required for tiki1/2 expression in the anterior pole, which may serve as a negative feedback loop. Notably, our data also indicate that TIKI1/2 is required for embryonic skeletogenesis by affecting PMC migration. Together, these results suggests that TIKI1/2 is critical in the regulation of Wnt/JNK signaling during A/P axis pattering and functions broadly to regulate the Wnt ligand activity during sea urchin embryogenesis.

Title: Promoting awareness and pharmacist-led interventions for fall prevention in older adults through community outreach.

Primary Author: Christian Allen

Additional Authors: Salisa Westrick;Lena McDowell;Amatallah Saulawa;Kassi Scott;Oluchukwu Maureen Ezeala;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: The older adult fall risk prevention outreach program is an interactive community health initiative focused on providing education regarding fall risk for those at risk of falls. Unintentional falls among older adults are rising and pose a significant risk to community safety and well-being. Many, often multifactorial, risk factors such as polypharmacy and unsafe living conditions contribute to elevating the risk and incidence of falls in older adults. This risk can be significantly reduced with appropriate and timely interventions by patients, pharmacists, and physicians. However, before implementing interventions, community awareness of the issue must be raised. Therefore, this program seeks to 1) provide general information regarding fall risk prevalence, risk factors, and complications and 2) provide actionable recommendations by which older adults can reduce their risk of falls. Starting in Spring 2025, multiple fall risk prevention informational sessions will be offered in various community settings in the Auburn/Opelika area such as Mercy Medical Clinic, Osher Lifelong Learning Institute, and Greater Peace Church. In these sessions, older adults will participate in interactive activities, including a general information session, the optional completion of a CDC fall risk assessment tool (STEADI), and a Q&A session led by pharmacy students. Measures to assess program effectiveness include 1) perceptions of: knowledge gained, awareness of individual fall risk, empowerment to use knowledge gained for themselves or others; 2) likelihood of: seeking additional risk assessments, exploring risk factor modifications; 3) satisfaction with information and materials provided. Results will be used for continual program improvement. This community outreach initiative aims to enhance awareness and empower older adults in the Auburn/Opelika area to actively engage in fall risk prevention and ultimately improve community safety and well-being.

Title: Co-delivery of curcumin and sildenafil citrate with 3D-printed collagen-chitosan scaffolds for enhanced wound healing

Primary Author: Chu Zhang

Additional Authors: Robert "Rusty" Arnold;Jayachandra Ramapuram;Oladiran Fasina;Manjusha Annaji;Ishwor Poudel;Nur Mita;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Wound healing remains a significant challenge due to its complex process involving hemostasis, inflammation, proliferation, and remodeling in tissue repair or regeneration. Advancements in wound healing therapies are needed to alleviate this healthcare concern. Curcumin (CUR) is a natural hydrophobic compound with anti-infective, anti-inflammatory, antioxidant, and healing properties. Sildenafil citrate (SC), a selective and potent inhibitor of cGMP-specific phosphodiesterase type 5 (PDE-5), is FDA-approved and used as a vascular dilator for treating erectile dysfunction and pulmonary hypertension. Studies have also shown that SC promotes wound healing through its ability to sustain the cGMP-enhancing effect of nitric oxide release but has poor physiochemical properties. In this study, 3D-printed collagen-chitosan scaffolds incorporated with CUR and SC were designed and fabricated using an extrusion-based bioprinter to aid in wound healing. Both collagen and chitosan are biodegradable and biocompatible polymers used clinically as drug delivery matrices. Physiochemical properties, including rheology of bioinks, physical assessment, morphological evaluation, water retention capacity, and degradation study of these lyophilized scaffolds were characterized. Content uniformity and thermal properties were analyzed using HPLC and differential scanning calorimetry (DSC), respectively. A novel analytical HPLC method was developed and validated to quantify the co-drug formulations simultaneously. <<In vitro>> drug release profiles were also evaluated over a 7-day period. Ultimately, we successfully obtained 3D-printed scaffolds with uniform drug distribution and improved structural stability. DSC thermograms suggested the thermal and molecular stability of the scaffolds. The release study demonstrated both CUR and SC can be fully eluted within 7 days. These scaffolds will be further assessed for their antimicrobial efficacy over time and their biocompatibility with fibroblasts.

Title: Quantitative Susceptibility Mapping as a biomarker for brain aging in schizophrenia

Primary Author: Clara Meincke

Additional Authors:

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: Schizophrenia is a serious mental illness that can cause severe hallucinations, such as seeing things and hearing voices that others do not perceive. If left untreated, schizophrenia can cause patients to lose touch with reality, making timely diagnosis and treatment essential. However, current diagnostic methods rely primarily on behavioral assessments due to the lack of MRI biomarkers that can objectively diagnose schizophrenia. Changes in brain morphology and altered iron metabolism have been hypothesized to be associated with the disease. Quantitative susceptibility mapping (QSM) is a novel MR technique to determine local tissue susceptibility as a quantitative marker of tissue iron. QSM has been used to assess brain iron content in the brains of patients with first-episode schizophrenia, however, relationships remain unclear. The overarching aim of this research is to determine if aberrant brain aging is associated with increased iron deposition. Eight adult subjects underwent 3-dimensional multi-gradient echo MR imaging at 7T TerraX scanner. QSM maps were generated offline in MATLAB using the MEDI toolbox. Regional susceptibility values were investigated by determining the average of QSM values within a segmented region from the QSM maps. The results showed an average χ-value of -0.0048 ± 0.0023 ppm across the eight patients, demonstrating consistency across subjects. Each patient's gray matter map was extracted and multiplied by their corresponding QSM map to determine the χ-value within gray matter. Repeating this process over time allows objective comparison of χ-values and volume changes, with higher χ-values indicating increased iron accumulation in gray matter. In summary, this pilot study produced reproducible QSM maps, enabling accurate clinical interpretation of longitudinal QSM changes. This approach provides a potential biomarker for detecting signs of brain aging, which could contribute to the objective diagnosis of schizophrenia

Title: Postharvest Assessment of Rabbiteye and Southern Highbush Blueberry Quality and Flavor Attributes

Primary Author: Clarisse Cochran Chipura

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

Department/Program: Horticulture

College: College of Agriculture

Abstract: Blueberries (Vaccinium spp.) are valued for flavor and phytonutrient content, yet postharvest data on rabbiteye (RE; V. virgatum A.) is limited. The objective of this study was to assess postharvest and visual quality of 16 RE and 3 southern highbush (SHB; V. corymbosum L.). Fruit was harvested from EV Smith Research Center then stored at 4°C, 85% relative humidity. Sampling occurred on days 0, 14, 28, and 42 of storage. Colorimeter (L*, a*, b*, C*, h), soluble solids content (SSC, °Brix), titratable acidity (TA), pH, total anthocyanins (mg/g), phenolics (mg/100g) and antioxidants (mM/100g) were collected. Cultivar differences were found in L*, a*, and b* CIELAB units. 'Legacy' and 'Alapaha' had the lowest L* (27.9, 28.0), while 'New Hanover' and 'NC5303' had the highest a* (1.3, 1.2). 'Overtime' and 'Vernon' had the lowest b* (-4.0, -3.9). SSC stayed stable, but TA increased from 0.41 (day 0) to 0.51 (day 42). 'Brightwell' (16.5 °Brix) and 'Ochlocknee' (16.0 °Brix) had the highest SSC while 'New Hanover' (12.1 °Brix) and 'T-3075' (12.2 °Brix) had the lowest. 'Vernon' (0.60) and 'Climax' (0.61) had the highest TA, while 'Alapaha' (0.36) had the lowest. Phenolic and antioxidant activity showed cultivar*timepoint interaction, with little anthocyanin change. 'Alapaha' (309.8 mg/g, 22.7 mg/100g) and 'Brightwell' (326.7 mg/g, 23.3 mg/100g) had high phytonutrients. Principal component analysis (PCA) and hierarchical cluster analysis (HCA) were run to identify genotypes with enhanced traits for sub-selections. PCA showed SHB correlated positively with b*, a*, and pH. HCA showed MS selections had enhanced phytonutrients but suppressed SSC, TA and phytonutrients. Six genotypes 'Titan', 'Brightwell', 'T-3072', 'T-3075' (RE), 'Legacy' and 'New Hanover' (SHB) were selected for consumer and electronic sensing analysis. Identifying fruit quality and flavor differences will help improve RE germplasm by selecting high-quality traits for consumer acceptance.

Title: Examining Cannabis Cue Reactivity in Women with Cannabis Use Disorder Versus Psycho-diagnostically Matched Controls

Primary Author: Clarisse Nacilla

Additional Authors: Richard Macatee;Aishwarya Chowdhary;Thomas Preston;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Cannabis use disorder (CUD) prevalence continues to rise in the United States with increased accessibility to cannabis and lessened stigma associated with use. Proponents of the allostatic model of addiction suggest that sensitization of reward-related systems to drug-related stimuli maintains harmful substance use. In those with CUD, neurophysiologically-derived event-related potentials that measure sustained, motivated attention (i.e., the Late Positive Potential [LPP]) have previously shown larger amplitudes to cannabis cues relative to neutral cues; however, confounding variables, such as psychodiagnostics status, may influence neurophysiological reactivity. The current study examines the difference in Cannabis-Neutral LPP between women with severe CUD (n=29) and a psychodiagnostically matched control group (n=33). Results showed a significant group (CUD vs. Control)*picture type (i.e., Cannabis vs. Neutral) interaction ($F[2,117]=3.07$, $p = .029$, $\eta p2=.049$). Probing of this interaction revealed that the CUD group demonstrated a significantly larger LPP to cannabis cues than the control group. There was no significant difference between the LPP to cannabis and neutral cues in the CUD group, whereas the Control group showed significantly higher LPP amplitudes to neutral compared to cannabis cues. Results suggest that, as predicted, those with CUD demonstrated greater neurophysiological reactivity to cannabis cues compared to a psychiatric control group. Comparable neurophysiological reactivity to cannabis and neutral cues in the CUD group may reflect the influence of sex-specific confounding variables (e.g., menstrual cycle phase, hormonal contraceptive use) on drug cue reactivity in females.

Title: Treadmills vs tumors: moderate aerobic exercise reduces tumor burden in a K-Ras mutant lung cancer model

Primary Author: Cole Viscome

Additional Authors: Kari Dugger;Ethan Burton;Matthew Blalock;Christopher Beskow;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Regular physical activity has been correlated with reduced cancer incidence and progression, but the underlying biology of this correlation is unknown. Evidence indicates that aerobic exercise may alter the immune system to enhance anti-cancer responses, yet few preclinical data exists to confirm this. We proposed that aerobic exercise would hinder the onset, growth, and metastasis of lung cancer in a genetically modified mouse model, CCSPCre/LSL-KrasG12D. To address this hypothesis, CCSPCre/LSL-KrasG12D mice were grouped by sex and randomly assigned to exercise or sedentary control groups. The exercise group underwent 10 weeks of treadmill running at a moderate intensity (13.5 m/min for 45 minutes/day, five days per week), starting at 4 weeks of age when lung tumors typically begin to develop in these mice. Lungs were assessed for tumor burden, while spleens were evaluated for weight and pro-inflammatory cytokine production known to support metastasis of cancer. Data showed that exercise significantly reduced tumor burden in the lungs of 14-week-old CCSPCre/LSL-KrasG12D mice. This was evidenced by fewer lung tumors ($p \leq 0.001$) and reduced lung tumor volume ($p \leq 0.001$) compared to the sedentary group. Interestingly, splenic TNF-α levels were elevated in exercised mice compared to control sedentary mice ($pp \leq 0.01$), while IL-6 levels were trending downward in exercised mice. This study builds on previous research showing that exercise enhances immunosurveillance and could support anti-tumor control. The results confirm aerobic exercise can reduce tumor burden and growth in a spontaneous lung cancer mouse model indicating a potential for exercise to be beneficial as an adjunct therapy in cancer treatment plans of metastatic cancer.

Title: Mechanical properties of polypropylene composites reinforced with wood fibers produced from the downed timber

Primary Author: Courtney Higgins

Additional Authors: Ke Zhan;Yucheng Peng;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Hurricanes and tornadoes generate a large volume of downed timber in the southeastern United States each year. Utilizing this timber as a source of wood fibers (WFs) for reinforcing polypropylene (PP) could help mitigate landowners' economic losses. This study investigated the mechanical properties of PP composites reinforced with WFs produced from the downed timber, evaluating the effects of tree age (15, 30, and 39 years), environmental exposure time (0, 6, and 12 months), and loading level (30, 40, and 50 wt.%). The tree age emerged as the dominant factor affecting impact, tensile, and flexural strength, while the loading level played a key role in enhancing the tensile and flexural modules of elasticity (MOE). The environmental exposure time showed relatively small and irregular influence in both strength and modulus. The WFs from the 15-year-old tree exhibited lower performance due to a high proportion of juvenile wood. In contrast, the WFs from the 30-year-old tree, with higher cellulose content and lower microfibril angle, contributed to superior polymer composite mechanical properties reinforcing effect. The WFs from the 39-year-old tree contained greater extractive content, distinctly weakening interfacial adhesion with the PP matrix. The highest mechanical performance was observed in the composite reinforced with 50 wt.% WFs from the 30-year-old tree after 12 months of exposure, achieving 132%, 50.2%, 229%, 76.9%, and 190% improvements over the neat PP in impact strength, tensile strength, tensile MOE, flexural strength, and flexural MOE, respectively. These findings demonstrated the potential of using WFs derived from the downed timber as effective reinforcing materials for PP.

Title: Rationalizing the interplay between defects, electrodes, and phases in single-crystal transition metal dichalcogenide memristors

Primary Author: Dakotah Kirk

Additional Authors: Lu Wang;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Memristors are material devices with non-volatile resistance states that have been recently demonstrated experimentally in two-dimensional semiconducting transition metal dichalcogenides (TMDs). Since then, efforts have focused on the advantages of size scaling and elucidating the underlying mechanisms of these systems. Previously, we showed that in TMDs (MoSe2, WSe2) the primary mechanism of this behavior is an insulator-to-metal (1H-to-1T') phase change phase facilitated by the electrodes. The TMD dielectric environment of the electrode and atom from the electrode migration into TMD vacancies lower the energy barrier of the 1T' phase, allowing for this phase change to occur. Building on this prior work, we provide a framework for engineering TMD memristors with improved performance. To this end, we analyze the changes in electronic properties within hybrid heterostructures formed with the group-VI monolayer semiconducting TMDs (MoSe2, WSe2, MoS2, WS2 , and MoTe2) and various transition metals (TM) electrodes employing first-principles calculations within density functional theory (DFT). In this combinatorial search, we utilize a high-throughput approach for different electrode/TMD compositions to establish the memristive structure-property relationship. This set of calculations – which includes different TMD thickness, epitaxial relationships, stoichiometries, etc. – are employed to rationalize memristive features in terms of their constituent material properties utilizing Linear Dimensionality Reduction methods. Overall, this work provides valuable insights into tuning memristive device parameters through composition, which may ultimately advance next-generation flexible memory and neuromorphic computing systems. The authors acknowledge support from the National Science Foundation (NSF) Grant No. 1848344.

Title: Prevalence and Spread of Antimicrobial Resistant Pathogens in Backyard Poultry Farms

Primary Author: Daniel Golden

Additional Authors: Brigid McCrea;Laura Huber;Pankaj Prakash Gaonkar;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Antimicrobial resistance (AMR) is a growing global health concern, with resistant pathogens found across various environmental reservoirs. While extensive research has shown that commercial poultry production exerts significant selective pressure that promotes the development and spread of AMR pathogens, little is known about the effects of small-scale backyard poultry farming on AMR prevalence and transmission. This study aims to address this gap by investigating the presence and spread of AMR pathogens in backyard poultry farms and assessing how this sector contributes to the overall risk of AMR in agricultural and community settings. In this study, five sample types, including chicken fecal matter, litter, soil from inside (direct contact with chickens) and outside (no direct contact with chickens) of the chicken coop, and a fecal sample from outside the chicken coop of unknown origin (wild or domestic animal) will be collected from each farm. Serial dilutions will be performed on the enriched samples to achieve three target dilution levels. Each dilution will be plated on CHROMagar, both with and without antibiotics for the selective culturing of susceptible and resistant-Escherichia coli and incubated at 37°C for colony enumeration. Three representative isolates will be selected from each growth condition. These isolates will then be used for further disk diffusion tests and sequencing to characterize their phenotypes and genotypes. In addition to screening for ESBL E. coli, 38 farms were screened for Salmonella spp. using MDS. Preliminary analysis indicates MDS-Salmonella detected in two bonus feces samples and one litter sample, though the organism could not be successfully cultured, while virulence genes associated with avian pathogenic Escherichia coli (APEC) were identified in at least one instance across all sample types. Additionally, three samples tested positive for extended-spectrum beta-lactamase (ESBL) producing E. coli. Complementary data from farm questionnaires on practices related to sanitation, species interactions, and antimicrobial usage (AMU) have been collected. It will provide context for observed AMR patterns and inform potential risk factors associated with its transmission. Although selective pressures associated with antimicrobial resistance are generally more pronounced in commercial poultry due to higher animal density and frequent AMU, the lack of biosecurity in backyard poultry farming presents unique risks. Common biosecurity gaps, such as limited sanitation practices, open access to multiple species, and infrequent health monitoring, create conditions conducive to AMR development and transmission. This study aims to reveal the prevalence and spread of AMR within backyard poultry environments, shedding light on the role these settings play in broader community AMR dynamics and informing targeted AMR mitigation strategies.

Title: Effect of pH on Dimensional Stability of TCNF 3D Aerogel Structures.

Primary Author: Daniel Owusu Sekyere

Additional Authors: Soledad Peresin;Fatimatu Bello;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Cellulose and chitosan offer sustainable alternatives to synthetic materials due to their renewability, biocompatibility, and biodegradability. While much research has focused on their use in aerogels for environmental applications, the effect of pH on the dimensional stability of these aerogels remains underexplored. This study investigates how varying pH levels affect the structural stability of TEMPO-oxidized cellulose nanofiber (TCNF) and chitosan aerogels. Understanding pH-induced changes in stability is crucial for ensuring the long-term effectiveness of these aerogels in emerging contaminant removal under different environmental conditions. By isolating pH as the key factor, this work aims to optimize the stability of TCNF-based aerogels for water remediation applications. This study aims to develop stable composite aerogels from TEMPO-oxidized cellulose nanofibers (TCNF) and chitosan (Ch) for the removal of emerging contaminants from water. Chitosan was dispersed in 1% acetic acid with sodium acetate, while TCNF was prepared separately under the same conditions. The solutions were combined in varying compositions, adjusted to pH levels of 2, 4, and 5.5, then frozen, ethanol-exchanged, and air-dried to produce aerogels. The resulting aerogels were evaluated for stability, chemical structural change, and morphology. Aerogels prepared at pH 4 demonstrated superior dimensional stability and water absorption, while chitosan enhanced long-term stability in aqueous environments. FTIR analysis confirmed that the carboxyl group introduced into the tempo oxidized at 1716 cm^{-1} and the amine group in the chitosan at 1609 cm^{-1}. XRD analysis indicated that chitosan addition reduced TCNF crystallinity, with increased structural disorder at lower pH levels. These findings highlight the potential of lightweight, bio-based TCNF/chitosan aerogels for water remediation and other environmental applications like tissue engineering and drug delivery applications.

Title: Effects of population changes and sampling heterogeneity on long-term changes in small mammal communities on Alabama State Lands

Primary Author: Darcey Gans

Additional Authors: Justin Hall;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Repeated monitoring is fundamental in an adaptive management framework to measure progress towards management goals. Unfortunately, agencies rarely have the resources to continually monitor biodiversity responses to ensure long term success. In 2008-2011 though, Auburn University and the Alabama Department of Conservation and Natural Resources (ADCNR) initiated an inventory and conservation planning (ICP1) project in which they surveyed small mammal communities on 14 state properties to improve understanding of native species assembly and occupancy rates. The findings of ICP1 were provided to ADCNR as a means to inform the management actions that the agency would take for the next 15 years. In 2024 we initiated a new round of small mammal surveys (ICP2) to evaluate community response to landscape changes resulting from ADCNR's management actions on its properties. Six properties were resampled between August-November 2024. Average capture rates were calculated for each species at each property. Across the six resampled properties, ICP1 sampling efforts detected 17 different species while ICP2 survey efforts have detected only 10 thus far. Preliminary findings indicate that ICP1 had an average capture rate 208.9 times higher than the capture rate of species in ICP2, with species such as Blarina Brevicauda captured 37. 96 times more often, Ochrotomys nutalli 1137.88 times more, and Peromyscous Leucopus captured 243.18 times more often in ICP1 surveys than ICP2. Although these early results indicate a dramatic decline in small mammal diversity and abundance since 2008, such species are also subject to high degrees of inter-annual population variability, and we expect that continued sampling for the next two field seasons (2025-2026) are likely to yield more species and potentially greater capture rates. Future research will also evaluate how variations in trap timing and methods may help minimize interannual heterogeneity and generate more accurate estimates of population change.

Title: Enhancing the efficiency of xenogenic catfish production by transplanting in vitro cultured blue catfish, (Ictalurus furcatus) stem cells into channel catfish, (I. punctatus) triploid fry

Primary Author: Darshika Udari Hettiarachchi

Additional Authors: Misha Soman;Rex Dunham;Ian Butts;Ahmed Elewa Shaaban;Dhanuka Bambaranda Hewage;Nadeen Abdo;Hamza Dilawar;Baofeng Su;Mei Shang;Kate Pottle;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Xenogenesis is an enhanced hatchery technology for hybrid catfish (channel catfish, Ictalurus punctatus ♀ × blue catfish, I. furcatus ♂) embryo production. This method can be accomplished by transplanting germline stem cells from a diploid donor fish into a sterile recipient, leading to the production of donor derived gametes. Currently, freshly extracted stem cells are used, which presents challenges as germline stem cell production depends on the donor's age, size, and seasonal cycles. In addition, collecting an adequate number of stem cells for transplantation is challenging, and cells can be damaged by proteinases (trypsinization) during stem cell extraction. Thus, in vitro propagation of stem cells would solve these issues by providing a year-round supply, which can significantly enhance the efficiency of the xenogenesis process. The present study aimed to compare the effectiveness of using fresh versus cultured oogonial stem cells (OSCs) and spermatogonial stem cells (SSCs) for germ cell transplantation. During the present study, triploid channel catfish fry were injected at 5 days post-hatch (DPH) with either freshly isolated or cultured OSCs or SSCs labeled with PKH26 dye. Growth performance and survival of recipient fish were assessed at 45 and 90 DPH. Additionally, colonization of donor cells in the recipients was quantified using PKH26 dye fluorescence to calculate the percentage cell and cluster areas. PCR and fluorescence image data were used to determine the percentage of xenogens. At 45 and 90 DPH, no significant differences in body weight or total length of fry were observed between treatments ($P > 0.05$). However, fluorescence image analysis revealed that recipient fish injected with cultured OSCs and SSCs exhibited a higher percentage of cluster area ($P < 0.05$) compared to those injected with fresh stem cells at both sampling periods. Additionally, a significant increase in percentage of cluster area was observed from 45 to 90 DPH in both cultured and freshly transplanted treatments. The percent cell area at 45 DPH was significantly higher in cultured OSCs and SSCs treatments ($P < 0.05$) than freshly transplanted treatments, while no significant difference was noted at 90 DPH between freshly transplanted and cultured treatments ($P > 0.05$). PCR analyses showed that a higher proportion of xenogens (85.7%) were found in recipient fish injected with cultured stem cells, compared to freshly transplanted stem cells (83.3%). Overall, the findings from the current study demonstrate that cultured stem cells exhibit comparable performance to freshly extracted stem cells across all measured variables. Therefore, cultured stem cells present a promising option for future germ cell transplantation to support xenogenesis without the need to sacrifice donors as they can be readily available under controlled culture conditions, enhancing the efficiency of germ cell transplantation for commercial scale hybrid catfish production. Keywords; Xenogenesis, Blue catfish, Stem cells, Cell culture

Title: Structure formation in microgravity dusty plasma experiments.

Primary Author: David Goymer

Additional Authors: Bradley Andrew;Brooks Howe; Dr. Evdokiya Kostadinova

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Complex plasmas can self-organize into various crystalline and liquid structural states, providing an exceptional platform for modeling fundamental processes relevant to materials science. Recent experiments conducted aboard the International Space Station in the Plasmakristall-4 (PK-4) facility have revealed that dusty plasmas in microgravity can form filamentary structures resembling electrorheological materials or liquid crystals resulting from an anisotropic dust-dust interaction potential. Here we analyze video data from two types of PK-4 experiments. In the first, we investigate how changes in the formation and stability of filamentary structure in different pressure and current plasma conditions. In the second, we study the formation of crystalline structure for fixed plasma conditions but changing dust densities through dust cloud compression. The goal is to assess the coexistence of multiple structural states in microgravity dusty plasma – simultaneous existence of a hexagonal lattice, square lattice, and a disordered (liquid-like state). To determine the structure types, we calculate the bond-order parameter for different symmetries. We further quantify disorder concentration as the deviation from the average interparticle separation in each type of structure, which allows us to assess the rigidity of the domains. All authors acknowledge the joint ESA / Roscosmos Experiment Plasmakristall-4 (PK-4) onboard the International Space Station. This research is funded by NSF-PHY-2308742 and NSF EPSCoR FTPP OIA2148653, NSF 1740203, NASA JPL 1571701, DE-SC0021334, NSF 2308743, NVIDIA

Title: Gritty associations among psychosocial characteristics and health behaviors of undergraduate nursing students: a cross-sectional study.

Primary Author: David Murray

Additional Authors: Pamela Short;Laura Robinson;

Department/Program: Nursing

College: College of Nursing

Abstract: Background: Students pursuing Bachelor of Science in Nursing (BSN) degrees in the United States face significantly higher levels of stress and anxiety compared to their peers in other fields due to the competitive nature of program admissions, demanding coursework, and clinical experiences involving critically ill patients. In an effort to improve programmatic and professional resilience in our students, we sought first to characterize the psychological distress and relevant health behaviors in our student population. Methods: In April of 2024, we surveyed three cohorts of BSN students using previously validated instruments including the 7-item Generalized Anxiety Disorder (GAD-7), Pittsburg Sleep Quality Index (PSQI), International Physical Activity Questionnaire (IPAQ), a 7-item diet quality screener, the GRIT scale, the Multidimensional Scale of Perceived Social Support (MSPSS), and the perceived stress scale (PSS). Differences between cohorts were assessed with one way analysis of variance and Spearman correlations explored the relationships among variables. Results: Valid responses were obtained from 121 students. Median scores (interquartile range) were as follows: GAD-7, 7 (4-14); PSQI, 6 (4-8); Metabolic equivalents (METs) from IPAQ, 1457.4 (1399.5-1531.4); Healthy Eating Index (HEI), 51.4 (40.0-62.9); PSS, 22 (19-24); GRIT, 3.50 (3.16-3.75); MSPSS, 18.25 (16.75-19.50). No significant differences in measures were observed among the three cohorts. Grit was associated with social support (rho=.185, p=.042), sleep quality (rho=.206, p=.023) and diet quality (rho=.179, p=.049). Anxiety severity was associated strongly with perceived stress (rho=.707, p<.001), and inversely with sleep quality (rho=-.521, p<.001) and social support (rho=-.242, p=.008). Conclusions: These results suggest that health behaviors are strongly associated with psychosocial characteristics in this population. Efforts to improve health behaviors in BSN students may be beneficial in reducing stress and anxiety and improving resilience.

Title: Protective role of mammalian Sestrin2 against arsenic-induced cytotoxicity

Primary Author: David Ro

Additional Authors: Michkayla Prince; Colby Tillman; Mason McCollister;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Sestrins, proteins that accumulates in cells exposed to environmental or genotoxic stress, play an important role in cell health, protecting tissues from damage or death by removing reactive oxygen species and inhibiting mTORC1 to induce autophagy. Arsenic is an environmental pollutant and is classified as class 1A carcinogen. One member of the Sestrin family, Sestrin2, also plays a role in inducing autophagy, clearance of damaged proteins and organelles, which is crucial for cellular homeostasis and integrity. However, while the molecular mechanism by which Sestrin2 induces autophagy in cells and tissues has been studied, how it induces autophagy against arsenic-induced toxicity is significantly less understood. Given the importance of cellular homeostasis in controlling redox status and energy metabolism, it is important that this knowledge gap be filled. The goal of this project is to determine the novel defense mechanisms by which Sestrins protect mammalian cells through autophagy induction caused by arsenic-induced oxidative stress. Our central hypothesis is that the ULK1/Sestrin2 complex is activated by arsenic-induced oxidative stress, and that it induces autophagy, thus preventing further oxidative damage, improving cell metabolism. The following research questions will be pursued to test this hypothesis: 1) Are Sestrin2 and ULK1 robustly induced by ROS causing- arsenic? 2) How Sestrin2 regulates the gene and protein expressions of autophagy pathway? 3) Does the induction of Sestrin2 useful for autophagy activity, recycling of damaged protein? We will utilize western blotting, qRT-PCR and immunofluorescence techniques in wild type and Sestrin2- manipulated mammalian cells to investigate the protective roles of autophagy process against arsenic-induced toxicity. The work proposed here will shed new light on the physiological roles of Sestrin2 in maintaining cellular homeostasis and in protecting cells against arsenic-induced oxidative stress and its associated metabolic disease.

Title: Design and Validation of a Stiffness Emulating Robot

Primary Author: Davis Poole

Additional Authors: Kimberly Garza;Chad Rose;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract:

Title: The Calcium-Virulence Connection: Conservation Across Xylella fastidiosa Strains

Primary Author: Deekshya Adhikari

Additional Authors: Leonardo De La Fuente;Deepak Shantharaj;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Xylella fastidiosa (Xf), a xylem-limited bacteria is transmitted by insect vectors and infects >698 plants causing devastating diseases in grapes (Pierce's disease) and blueberries (bacterial leaf scorch), among others. Xf has developed the ability to manipulate the mineral composition of the xylem, a nutrient-poor environment subject to continuous flow. We showed that calcium (Ca) is a key regulator of virulence by enhancing virulence traits (biofilm formation, twitching motility) in the bacterium, and Xf infection induces higher Ca levels in xylem sap of multiple host plants. However, the effect of Ca on virulence among strains from different subspecies has not been studied. Here we investigate the impact of Ca supplementation on virulence and disease development across Xf strains from five different subspecies isolated in the US and Europe. Preliminary results show that adding Ca to growth media increases biofilm formation across Xf strains from genetically diverse subspecies. Interestingly, strains isolated from an island in Spain appeared to show stronger responses, suggesting a potential role of geographic origin in Ca responsiveness. Comparative genomic analysis will be done to assess the makeup of Ca-binding proteins across all Xf genomes. In twitching motility plate assays, preliminary results show that Ca supplementation enhances motility. To confirm these results, twitching motility will be assessed in microfluidic chambers that mimic flow conditions. Ongoing experiments in the greenhouse are testing the hypothesis that Ca amendments to potted plants increase symptoms development by Xf strains. By combining wet lab, molecular microbiology techniques, and bioinformatics this study will help understand the regulation of virulence by Ca among Xf strains.

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

Primary Author: Deepika Goyal

Additional Authors: Richard Bird;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: MicroRNAs (miRNAs) are small, 19–23 nucleotide-long noncoding RNA molecules that regulate gene expression at the post-transcriptional level. Their expression varies significantly in diseases such as cancer and autoimmune disorders compared to normal cells. MicroRNA 18a and 19a have differential expressions in canine mammary tumor cell lines and the exosomes released by these cells compared to normal epithelial cells. Using miRDB, we have identified miR-18a and miR-19a as potential regulators of estrogen receptor 1 (ESR1) gene expression. Like human breast cancer, canine mammary tumors can also be classified into four types depending on the presence or absence of Estrogen receptor, Progesterone receptor, and HER2. In this study, we are investigating the role of miR-18a and miR-19a in regulating Estrogen receptor 1 expression in the canine mammary tumor lines. Luciferase reporter assays confirmed that these miRNAs directly target the gene ESR1, leading to its differential expression in cancerous versus normal cells. Functional analyses revealed that miRNA-mediated suppression of ESR1 expression influenced key cellular processes, such as proliferation, migration, and invasion. These findings suggest that miRNAs targeting the ESR1 mRNA may serve as potential biomarkers or therapeutic targets in breast cancer. Future studies will explore the broader implications of this regulatory mechanism in tumor progression and treatment strategies.

Title: Induction of CYP3A4 by kratom and mitragynine: implications for HIV ART metabolism and botanical supplement use

Primary Author: Destini Thornton

Additional Authors: Angela Calderon;Satyanarayana Pondugula;Kiersten McCalpine;Gracie Farmer;Alex Shipp;Zarna Atul Raichura;

Department/Program: Pharmacal Sciences

College: Harrison College of Pharmacy

Abstract: Kratom (Mitragyna speciosa Korth) is a botanical supplement used for its analgesic effects and in managing opioid addiction. It is increasingly reported by individuals living with HIV (PLWH) to help alleviate chronic pain associated with the disease and antiretroviral therapy (ART). However, concerns arise from potential pharmacokinetic interactions between Kratom and HIV ART, as both are metabolized by cytochrome P450 3A4 (CYP3A4), the primary enzyme responsible for metabolizing many drugs. Interaction with CYP3A4 raises the possibility of altered ART metabolism, leading to therapeutic failure or drug toxicity. CYP3A4 induction is a process that can reduce drug plasma concentrations, thus diminishing drug effectiveness. Kratom contains alkaloids like mitragynine (MIT), which have been suggested as possible inducers of CYP3A4. The impact of Kratom and MIT on CYP3A4 activity in the presence of HIV ART was investigated. Sandwich-cultured human hepatocytes were treated with Kratom, MIT, Bicktarvy (1st line HIV ART drug), Symtuza (2nd line HIV ART drug) or a combination of Kratom or MIT and HIV ART drug 1st or 2nd lines. All single treatments or combinations were dosed at clinically relevant concentrations with Kratom and MIT having additional test concentrations of 20-fold lower and 20-fold higher than the human relevant concentration of 81.9 nM of MIT. After the 48 hour treatment time, mRNA was extracted, and quantitative PCR (qPCR) was used to assess CYP3A4 expression. Results showed significant induction (>2-fold) of CYP3A4 with Kratom single treatments and combinations at concentrations 20-fold higher than human relevancy (1638 nM of MIT). These findings suggest that Kratom may increase the metabolism of ART medications via CYP3A4 induction, potentially compromising their efficacy against HIV. Further research is needed to explore the clinical significance of these interactions and inform treatment strategies for PLWH using Kratom for pain management.

Title: Elucidation of canine adenoriruse type 2 tropism

Primary Author: Devin Cooper

Additional Authors: Payal Agarwal;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Cancer is a very dangerous disease, and millions are diagnosed each year. Chemotherapy and radiotherapy are some more common treatments, but a lesser known method that our research focuses on is virotherapy. This method involves using the natural processes of viruses to lyse tumor cells. The oncolytic virus used in our research is a modified adenovirus. CAV2 (Canine Adenovirus Type 2) is a similar virus to human adenovirus 5 (Ad5). CAV2 genome is well mapped but the receptors that it uses to infect a cell remain a mystery. It has been assumed that CAV2 uses the same receptors to enter the cells as Ad5, the CAR receptor. CAR mRNA expression levels were analyzed in various cell lines using RT-PCR (Reverse-transcriptase polymerase chain reaction). We noticed that cell lines infected by CAV2 do not always express CAR. We concluded that CAV2 can infect cells that do not express CAR and are refractory to Ad5 infection. We've proposed that inhibition of CAR expression will result in low Ad5 infections without affecting CAV2 infections. We inhibited CAR mRNA expression using siRNA in the cell lines infectible by CAV2 and Ad5. Post siRNA inhibition, the cells were infected with CAV2 and Ad5. The siRNA inhibition of CAR mRNA in canine cell lines MDCK and CML7 was successful. The cells transfected with anti-CAR siRNA showed low Ad5 infections, while CAV2 infection remained constant. To identify alternate receptors of CAV2, we performed pull-down assay using sulfo-SBED biotin label transfer assay. Based on the literature search and our pull-down assay, we identified two potential alternate receptors, DSG1 and CD46. Both receptors are expressed in CAV2-infected cell lines based on RT-PCR. SiRNA inhibition of CAR confirms that CAV2 can infect cells that no longer express CAR. Additionally, the qPCR results confirm the presence of DSG-1 and CD46 mRNA in the cells. To further verify that CAV2 uses DSG-1 and CD46, we propose siRNA inhibition experiments targeting DSG-1 and CD46.

Title: Understanding the Fundamental Influence of Wood Extractives on Wood adhesion

Primary Author: Diego Alejandro Cuartas Marulanda

Additional Authors: Soledad Peresin;Fatimatu Bello;Suhasini Gururaja;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Spotted gum (Corymbia critriodora) is a highly desirable hardwood species in Australia, recognized by the forestry industry for its rapid growth, durability, and appealing color. However, the widespread adoption of spotted gum in engineered wood products faces considerable obstacles, primarily due to two inherent characteristics. Firstly, its high concentration of lipids and phenolic compounds, which migrate to the wood surface during the drying process, creates a chemically inert layer that significantly hinders effective adhesive bonding. Secondly, the wood's dense structure, characterized by vessel cells naturally occluded by tyloses, impedes adhesive penetration, further complicating the gluing process. These characteristics of spotted gum create complex adhesion challenge and an innovative approach to mitigate it is warranted. This study aims to investigate the correlation between extractives composition and adhesion performance of spotted gum. To achieve this, we developed a novel approach that include weathering delamination testing of solid wood treated by systematic solvent extraction. Although solid wood extraction is rarely performed due to its complexity, this study aims to treat wood with solvents of varying polarities to evaluate how adhesive durability is associated with extractive removal and specific extractive compounds. Both untreated and extracted wood specimens are bonded in a cross-laminated structure, subjected to cyclic soaking and drying, and evaluated through critical crack density measurements to assess delamination and bonding performance. Early results show promising improvements in adhesion, with reduced delamination and delayed failure in treated samples. The outcomes are poised to revolutionize the economic and sustainable use of spotted gum and similar hardwoods in diverse applications, promoting the growth of the Australian forestry industry and enhancing the global viability of engineered wood solutions.

Title: Refugee camp design evolving from temporary to permanent settlement: Analyzing strategies implemented in opposite side of the world.

Primary Author: Dina Kisseleva

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: As conflict erupts and natural disasters occur, displaced people seek refuge after abandoning their homes for a new environment. The United Nations refugee agency has estimated that in 2024 over 122 million people were displaced worldwide. While many countries offer refugee camps, one-third of the world's refugees are found in five countries: the Islamic Republic of Iran, Türkiye, Colombia, Germany, and Uganda. Refugee camps worldwide cover the most basic necessities, such as sleeping arrangements and essential nourishment. Yet all country's guidelines and needs are different, and many lack essential components to allow refugees to prosper. Some camps develop more advanced settlements while others try to survive with the bare minimum. The purpose of this research is to examine the diverse design strategies employed by refugee camps in the aforementioned five countries that host the largest refugee populations, in an effort to seek to assess the factors that contribute to the successful integration of refugees into their new environments. By analyzing the built environment and infrastructure of these camps, as well as the ways in which they transition from temporary to more permanent settlements, this research will determine best practices for facilitating refugee adaptation. The findings will be synthesized into a comprehensive framework that categorizes the most effective strategies for improving refugees' quality of life and sense of agency. Ultimately, this research will inform the development of design guidelines for refugee camps that prioritize not only basic necessities such as shelter and food but also foster autonomy and dignity among residents.

Title: Microfibrillated Cellulose Beads: A Study on NaOH/Urea Dissolution and Acid Coagulation

Primary Author: Duber Esmely Garces Martinez

Additional Authors: Soledad Peresin;Adriana Restrepo Osorio;Sydnee Baker;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The development of microfibrillated cellulose (MFC) offers a pathway to create advanced materials with tailored functionalities, such as cellulose beads. These beads exhibit high porosity, adsorption, and controlled-release properties, making them suitable for applications such as water remediation, drug delivery, and the slow release of agrochemicals. This study proposes a novel methodology to produce cellulose beads utilizing mechanical treatment with a Supermasscolloider (Masuko) to obtain MFC with an appropriate degree of polymerization (DP) for dissolution in a low-temperature NaOH/urea system. This approach serves as an alternative to traditional methods that are based on complex techniques, such as enzymatic depolymerization combined with Papir- og Fiberinstituttet (PFI) mill refining. Three raw materials—bleached and unbleached softwood pulp and bleached soybean hulls—were evaluated and processed using the Supermasscolloider. The MFC solutions were dripped into coagulation baths containing sulfuric, nitric, or citric acid, resulting in the formation of hydrogel beads. The beads were characterized using scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and thermogravimetric analysis (TGA) to evaluate their structural, morphological, and thermal properties. The results showed that it is possible to produce beads with all three raw materials and acids. In addition, differences in bead morphology were associated with the strength of the acids in the coagulation bath, and some differences due to the presence of lignin were also observed. This methodology demonstrates that the appropriate DP for dissolution in a low-temperature NaOH/urea system can be achieved solely through mechanical treatment with the Supermasscolloider. Furthermore, the microfibrils obtained through this methodology can be used to produce beads in different types of acids, leading to specific properties in each case. By adjusting process variables, the properties of the beads can be tailored, offering a versatile platform for developing functional cellulose-based materials.

Title: Effect of photoperiod on largemouth bass, Micropterus salmoides, production efficiency during early ontogeny

Primary Author: Dustin Goodman

Additional Authors: Ian Butts;Nelson Sharma Parajuli;Anneleen Swanepoel;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Largemouth bass (LMB), Micropterus salmoides, is becoming an increasingly important global food fish species with an emphasis on recirculating aquaculture systems (RAS). From a management perspective, there are various factors that impact the success of RAS production, including photoperiod. Photoperiod has been shown to impact growth, and survival of various fish species. At present, no studies have investigated how photoperiod impacts production efficiency for LMB, especially during the critical early life stages. This study investigated the effects of three different photoperiods on growth and survival of LMB. Three photoperiods were used; 12L:12D, 16L:8D, and 24L:0D with 5 replicate tanks, each housing 50 fry per liter. Over 30 days, fry was fed 8 times a day from 07:00 to 23:00. Diets consisted of artemia at 8/mL for 30 days, rotifers at 5/mL for 2 days, and supplemental dry pellets were administered over time. Mortalities and water quality was quantified from each tank daily. On a weekly basis, starting at Day 0, fry (n = 12) were randomly selected from each tank and measured for morphometric data, including jaw length, myotome height, total body length, total body length, notochord length, body area, and fin fold area. Photoperiod did not impact fry survival and deformities. However, for final weight, the 16L:8D and 24L:0D treatments had heavier fish than the 12L:12D treatment. A similar trend was observed for total length, notochord length, body area and fin fold area, where fish reared at 12L:12D were smaller at 7, 14, 21, and 28 DPH compared to the other treatments. With early ontogeny being critical for successful production, this study shows the benefits of using longer intervals of photoperiod for LMB fry in RAS up to 28 days post hatch.

evanTitle: Effect of moisture content on physical and flow properties of pine residues, waste coal, and organic fraction of municipal solid waste blends

Primary Author: Edith Laure Yonguep Ngoupeyou

Additional Authors: Oladiran Fasina;Sushil Adhikari;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Combining waste coal, the organic fraction of municipal solid waste (OFMSW), and forest residues for clean energy production through thermochemical processes is a promising approach to utilizing diverse waste streams. This strategy reduces environmental impact and ensures a steady feedstock supply for biorefineries. However, feedstock variability in particle size, shape, moisture content, and cohesion pose challenges for efficient handling and system reliability. Understanding these properties is crucial for designing effective handling equipment. While previous studies have examined the flowability of individual biomass feedstocks, limited research has explored the impact of moisture on the flow behavior of pine residue–coal–OFMSW blends. This study investigates the effect of moisture content on the flow properties and physical characteristics of these blends. Ten different ratios of waste coal, pine residues, and OFMSW were prepared, and moisture levels were adjusted to 10, 20, 30, and 40% by adding water. Bulk, particle, and tap densities, flow index (FI), cohesion, and internal and wall friction angles were measured. Results showed that bulk and tap densities increased with moisture, while particle density decreased. Blends with higher coal and pine residue ratios exhibited greater bulk and tap densities, whereas those with high OFMSW content had lower bulk densities across moisture levels. The internal and wall friction angles increased significantly from 10% to 20% moisture, then slightly decreased at 30–40%. Blends with high pine residue ratios had the highest flow index and lowest cohesion, while those with high OFMSW had the lowest flow index and highest cohesive strength. These findings are essential for designing effective storage, processing, and handling systems for these materials, improving the feasibility of waste-derived energy solutions

Title: The Duo: An Illustrated Personal Design Process for an Inclusive, On Market Product

Primary Author: Edward Hosp

Additional Authors:

Department/Program: School of Industrial and Graphic Design

College: College of Architecture, Design and Construction

Abstract: An illustrated poster using an on-the-market product, the Duo Spinner, to demonstrate a personal design process as follows. The design process was started by interviewing the client. Before the process could start, the desired effect of the design must be known. Is it filling a hole in a market, or being fit to achieve a specific goal? Once the general direction of filling a hole in the market for an inclusive playground spinner was known, research could begin. This research ranged from scholarly reading, learning how to design around a new mechanic and for demographics with unique requirements, and investigating online retailers to see what was on the market. Looks and ideas from which to draw inspiration were compiled to inspire the sketching process. With developed CAD skills, the less traditional models were used to illustrate later concepts. The models were refined and drawings advanced until they were ready to show to the client. Once the model had been refined enough, it was tested through prototype development through 3D printing. If a roadblock was ever encountered, shifting to an abstract task such as model building helped to reset the type of thinking used by working with hands in a way that lets process thinking happen in the background. Once the CAD files had been detailed enough they were handed to engineering along with a CMF guide and use-case renders. This information was combined in a final presentation to the client. This personal design process has been used to bring the Duo, an inclusive children's playground spinner that was designed for children with cerebral palsy, autism, and other disorders, to market. The Duo is currently being sold by GameTime, a PlayCore Company, and is advertised as an inclusive playground spinner due to its accessible height, specially designed walls for physical support, and walled shape that prevents unwanted contact.

Title: Creating 3D tissue-engineered models to study lung cancer tumor microenvironment dynamics

Primary Author: Elham Seyyedi Zadeh

Additional Authors: Yuan Tian;Emma Berkley;Callie Pope;Kwaghtaver Samuel Desongu;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Lung cancer, particularly non-small cell lung cancer (NSCLC), is one of the most prevalent and significant causes of death around the world, highlighting the necessity for developing research models that properly mimic the tumor microenvironment (TME). In recent years, 3D in vitro cell culture models have emerged as essential tools for cancer research. These models allow researchers to replicate important TME conditions found in tumors within the human body. Considering tumor heterogeneity, the composition of cells differs spatially; some tumor regions may have more stromal cells than another. These differences can lead to variation in drug responses throughout the tumor. In this study, lung cancer cell lines were employed to develop 3D tissue-engineered models. We developed microspheres and engineered tissues by encapsulating Calu-3 lung cancer cells in PEG-fibrinogen hydrogels. Furthermore, we co-encapsulated Calu-3 cells with fibroblasts (Bj5ta cell line) at ratios recapitulating the cancer-to-stromal cells ratios found in patient lung cancer tumors to mimic the various compartments of the tumor. A custom microfluidic setup was employed for the production of tissue engineered Calu-3 lung cancer microspheres, which allowed us to have precise control over the cell encapsulation and make engineered lung cancer tissues that are amenable for use in future drug testing. Our results demonstrated that microspheres were highly uniform 24 h post-production, and the Calu-3 lung cancer cells are growing and forming larger colonies within the microspheres over time. It is observed that the encapsulated Calu-3 cells maintained high viability over time in both macro-scale and microsphere engineered Calu-3 lung cancer tissues. To investigate cell population behavior in the co-cultured engineered tissues after 8 days of culture, we performed flow cytometry experiments to immunostain the cells with the fibroblast marker (TE-7) and the proliferation marker (Ki67). We found that by day 8, the engineered tissues consisted of over 70% fibroblasts population. This is consistent with the relative growth rates of Calu-3 and Bj5ta in 2D monoculture. Mechanical properties of the hydrogel constructs have been shown to be a critical component of the tumor microenvironment, and encapsulated cells also actively remodel the environment. We used a parallel plate compression system to measure Young's modulus of the co-culture models (Bj5ta: Calu-3 = 1:1) on days 8 and 15. It was found that the stiffness of engineered tissues increased from 810 Pa to 1625 Pa from day 8 to 15. This increase could be caused by the growth of fibroblast cells, which is also confirmed by the flow cytometry results. This project shows that PEG-fibrinogen hydrogels could be useful for lung cancer research and also helps us understand how cancer cells and fibroblasts dynamically interact with each other in 3D in vitro culture. Future work will involve drug testing with the co-culture model to investigate whether the presence of stromal components leads to different drug responses.

Title: Flexibility in termite mating behavior sequences

Primary Author: Elijah Carroll

Additional Authors: Nobuaki Mizumoto;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Animal mating behavior often consists of a sequence of stereotyped actions that precede acquiring a mate. The evolutionary change of the sequence is a source of diversity in mating behavior. In termites, winged adults (alates) fly from the original nests to find both a mating partner and a site for colony foundation. In most species, alates must shed their wings before obtaining a partner because wings hinder tandem running, a courtship behavior by which partners search for a potential nesting site together. Thus, a typical sequence of termite mating is giving up dispersal, obtaining a partner, and finding a nest site. However, here we describe a unique tandem running behavior of an Australian termite, Microcerotermes nervosus; they can perform tandem runs with wings and are more likely to shed their wings in the presence of a partner. Our results show that 67% of winged females with a partner shed their wings, and the average time to wing shed was 262 seconds (~4.5 minutes). Female alates in the absence of a partner did not shed their wings (0/29) within a 30-minute time period. The speed of tandem was significantly greater when females had wings relative to wingless pairs. The stability of tandem runs decreased in pairs with winged females relative to wingless pairs. This species exhibited faster tandem running that was more stable relative to sympatric termite species. Given that mound nests of M. nervosus are abundant and ubiquitous in the studied area, this species could be less choosy about the nest site but instead more focused on securing the mating partner. Our results imply that the sequence of mating behaviors in termites can be largely variable, reflecting their nesting habitats.

Title: Can Taurine Regulate 3T3-L1 Preadipocyte Proliferation in Cell Culture?

Primary Author: Eliza McGuirk

Additional Authors: Terry Brandebourg;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Taurine is a naturally occurring amino acid that appears to have numerous health benefits, which might make it an inexpensive feed ingredient that promotes health in food animals. The ability to control how fat an animal gets can allow us to produce healthier animals that are also healthier for consumption. When fat cells develop in a growing animal, preadipocytes first appear and then divide to increase in cell number. Next, these cells differentiate into adult fat cells, which begin synthesizing and storing lipids as they grow bigger. I hypothesized that taurine could alter fat cell development. To test this hypothesis, I exposed cultures of 3T3-L1 preadipocytes to increasing amounts of exogenous taurine and examined the impact on preadipocyte proliferation in these cultures. To determine our dose, I first determined endogenous levels of taurine present within our cultures using high-performance liquid chromatography (HPLC). Serum-containing growth medium sampled before addition to cultures (0h) contained 3-fold higher taurine compared to taurine levels in conditioned medium sampled from cultures following 48h exposure to preadipocytes. Meanwhile, intracellular taurine levels within our cultured preadipocytes were 16-fold higher than that measured within the culture medium at 0 or 48h and were consistent with taurine levels reported in adipose tissue within the literature. These results suggest that preadipocytes readily absorb exogenous taurine. Next, I tested the ability of taurine to alter preadipocyte proliferation by treating cultures of 3T3-L1 preadipocytes with increasing amounts of exogenous taurine (0, 10M, 100 nM, 1µM, 10µM) and estimating cell number using resazurin (fluorescent) and MTT (colorimetric) assays. Increasing doses of taurine consistently caused a dose-dependent increase in cell proliferation, with the highest response being 28% compared to control values. These results support the hypothesis that taurine can regulate fat cell development.

Title: Marine bioactives: unveiling the ocean's lifesaving pharmacodynamic approach for better therapeutic efficacy for anaphylaxis treatment

Primary Author: Elizabeth McDonnell

Additional Authors: Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Anaphylaxis is an immediate, severe, and potentially life-threatening hypersensitivity reaction triggered by allergen exposure. It is an escalating global health concern across all age groups and regions. In the United States alone, at least 25,000 cases of anaphylaxis occur annually, with an estimated 63 to 225 related deaths per year. The most common triggers include food allergens (such as nuts, shellfish, and dairy products), medications (penicillin, aspirin), venom from insect stings (bees), and latex. Although treatments such as antihistamines, corticosteroids, and beta-adrenergic agonists are available, epinephrine remains the first-line and lifesaving therapy due to its rapid action in reversing anaphylactic symptoms by stimulating the adrenergic nervous system and stabilizing the immune response. However, despite its efficacy, epinephrine presents several challenges, including potential adverse effects on multiple organ systems, high cost, short shelf life, strict storage requirements, and the necessity for proper administration to ensure optimal effectiveness. To address these limitations, researchers are exploring marine bioactives as alternative treatments for anaphylaxis. Emerging studies highlight the therapeutic potential of bioactive compounds derived from Sargassum horneri (brown algae), abalone, crustacean exoskeletons, and seaweed. These marine-derived natural bioactives exhibit promising anti-allergic pharmacological properties, potentially mitigating anaphylactic reactions and reducing associated morbidity and mortality. This study aims to collate and summarize current research on marine bioactives in anaphylaxis treatment, evaluate their clinical applications, and identify future research directions. By broadening therapeutic options, this research seeks to contribute to the development of safer, more effective, and accessible treatments for anaphylaxis.

Title: The role of achilles tendon structure in foot arch height and walking gait in healthy adults

Primary Author: Elizabeth Wheeler

Additional Authors: weimawh;John Grace;Bahman Adlou;

Department/Program: School of Kinesiology

College: College of Education

Abstract: The Achilles tendon (AT) is a major soft tissue in the lower leg that plays an integral part in human gait. The AT's structure is associated with arch height, but there is limited literature on how its impact on foot structure affects walking gait in healthy adults. This study aimed to investigate how the structural properties of the AT, notably thickness and cross-sectional area, correlate with arch height and foot biomechanics during walking. Ten able-bodied, uninjured adults (5 females) participated in this study. Their basic demographics and anthropometrics were obtained. AT thickness and cross-sectional area were measured at the junction between the malleoli using portable ultrasound. Each participant walked 20 times on an instrumented walkway at a self-selected speed to capture gait variables. The relationship between the AT and foot structure was examined using a linear regression model. One-way ANOVA was performed to explore the effect of AT structure on walking gait. AT structure and gait variables were normalized to body weight and limb height, respectively. The significance level was set to alpha .05. It is hypothesized that one or both AT structures are relatively correlated with arch height values. Additionally, a relatively high level of variance in walking gait variables would be accounted for by the AT structures. These results underscore the importance of considering Achilles tendon properties in clinical assessments and treatments related to gait and foot structure. Understanding the correlation between AT structure and foot biomechanics can aid in developing targeted interventions for gait abnormalities. Insights from this study could inform preventive strategies for injuries related to the Achilles tendon and foot structure and help in designing personalized rehabilitation programs.

Title: Are endogenous ERBB4 ligands necessary for the proliferation of BRAF-WT melanoma cell lines?

Primary Author: Ella Wilson

Additional Authors: David Riese;Haram Kim;Vipasha Dwivedi;Madison Zelan;Markelle Scott;Allie Pegel;Tate Reese;Charleigh Gumapac;Teigen Nelson;Nick DeFeo;Tori Huffman;

Department/Program: Phamacy

College: Harrison College of Pharmacy

Abstract: Approximately 50% of melanomas harbor a gain-of-function mutation in a BRAF allele, and these tumors respond to immune checkpoint inhibitors (ICIs) or a combination of BRAF and MEK inhibitors. Unfortunately, the ~50% of melanomas that possess wild-type BRAF alleles (BRAF-WT melanomas) are not responsive to targeted therapeutics, and ICIs are not highly effective against these tumors. Thus, our long-term goal is to identify the drivers of BRAF-WT melanomas. In silico analyses of tumor genomes and gene expression patterns suggest that endogenous ERBB4 transcription or endogenous gain-of-function ERBB4 mutant alleles drive the proliferation of BRAF-WT melanomas. Indeed, we have demonstrated that ERBB4 is sufficient and necessary for the proliferation of four BRAF-WT melanoma cell lines. However, absolute ERBB4 transcription is relatively low in BRAF-WT melanoma samples and ERBB4-dependent BRAF-WT melanoma cell lines. Thus, we have hypothesized that ERBB4 ligands (members of the epidermal growth factor family of peptide hormones) are also necessary for the proliferation of BRAF-WT melanoma cell lines. We are testing this hypothesis by measuring whether the ERBB4 full agonist Neuregulin 2beta (NRG2beta) stimulates the proliferation of ERBB4-dependent BRAF-WT melanoma cell lines. We will also measure whether the NRG2beta Q43L mutant protein (a partial agonist/antagonist at ERBB4) inhibits the proliferation of ERBB4-dependent BRAF-WT melanoma cell lines. Positive results will suggest strategies for identifying BRAF-WT melanomas that are ERBB4-dependent and predicted to respond to drugs that inhibit ERBB4 signaling.

Title: Designing for dignity a human centered approach to inpatient psychiatric care

Primary Author: Ellie Rea

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Psychiatric healthcare facilities are often perceived as sterile spaces designed primarily for observation and safety; the healing process can often be lower in priority. While patient monitoring is essential within inpatient settings, a human-centered approach requires fostering a sense of autonomy and personal control over one's space and belongings. The perception of constant surveillance, coupled with an inability to claim a defined personal territory, can undermine a patient's healing, possibly fostering mistrust between patients and caregivers. The built environment plays a pivotal role in mitigating this dynamic, offering design solutions that enhance patient autonomy while maintaining necessary oversight. Designing in healthcare settings requires evidence-based research that transcends aesthetics and that prioritizes functionality, safety, and psychological well-being. The most successful psychiatric healthcare environments employ a human-centered approach that thoughtfully integrates spatial planning and architectural strategies to support both patient recovery and staff efficiency. A well-designed inpatient room should provide a sense of routine and normalcy without imposing rigidity, ensuring that both patients and caregivers feel supported within the space. The purpose of this research is to offer one design solution for a single patient room taking autonomy, privacy, and safety into consideration. By analyzing precedent studies, hospital design guidelines, building codes, and current evidence-based practices, this study seeks to be the first step for exploring a new standard for inpatient psychiatric environments. The proposed design aims to create a space that upholds patient dignity and personal agency while maintaining the necessary safeguards for therapeutic care.

Title: What matters and for whom? Risk and protective factors associated with food insecurity severity among military-connected families

Primary Author: Emily Hanson

Additional Authors: Mallory Lucier-Greer;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Recent evidence suggests that Service members experience food insecurity at nearly twice the rate of civilians. Indicators of financial instability tend to explain many antecedents to food insecurity among civilians, yet risk factors of food insecurity may be different for military-connected families (active duty and Veteran). Active-duty families have access to a regular income and other resources positioned to promote economic stability. However, for these currently serving families, the military lifestyle can also be highly mobile, introducing unique barriers to stability (e.g., spouse unemployment). For formerly serving (i.e., Veteran) families, differences in the civilian job market and community systems at play may impact employment and access to resources, all possible risk factors of food security and resource utilization. There are also unique facilitators that can bolster well-being among this population, such as shared culture and social support. The primary objective of this study is to determine the prevalence and predictors of food insecurity among 1,304 military-connected families – both active duty and Veteran – who participate in Blue Star Families, a nonprofit with the mission of strengthening military families by creating communities of support. Multinomial logistic regression models identified risk (e.g., unemployment, number of children) and protective factors (e.g., nonprofit support) associated with the severity of food insecurity. These models were fit separately based on military status, specifically, active-duty Service members, active-duty spouses, Veterans, and Veteran spouses. Findings are positioned to advance the conversation on the prevalence of food security, assist in the screening and identification of families at risk of food insecurity, and enhance understanding of how nonprofits can support at-risk families.

Title: Taxonomic and functional composition of the fecal gut microbiota before and after exercise training in diet-induced obese mice

Primary Author: Emily Knight

Additional Authors: Ramesh Jeganathan;Geetha Thangiah;Lauren Jun;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: The gut microbiota encompasses all microorganisms residing within an individual's gastrointestinal tract and plays a key role in host energy homeostasis. Alterations in gut microbial composition that negatively impact host health result in dysbiosis, which has been observed in individuals with obesity and mice with diet and genetically induced obesity. These compositional differences are characterized by an increased energy harvesting capacity and alterations in short-chain fatty acid (SCFA) concentrations. Although physical activity is a key lifestyle intervention for obesity treatment and management, its effect on the gut microbiota remains poorly understood. Given that exercise increases the body's energy demands through energy expenditure, we investigated the impact of 12-week moderate treadmill exercise on the gut microbiota of male mice fed a high-fat, high-sugar (HFHS) or standard chow diet. Pre- and post-intervention fecal samples were analyzed using gas chromatography-mass spectrometry for SCFA quantification and shotgun sequencing at a depth of 13M reads for microbial characterization. Compared to their sedentary counterparts, exercised mice had significantly lower weight gain by the end of the intervention. We also observed the impact of the HFHS diet on microbial taxonomic and functional composition. Total SCFA concentration did not differ between groups over the course of the study, except for increased levels in the control group compared to baseline. Propanoic acid concentrations decreased, while formic acid concentrations increased in both HFHS groups. Additionally, pentatonic acid and propanoic acid concentrations were lower in both HFHS groups compared to control mice at the end of the study. Overall, our results support the ability of a western style diet to alter microbial composition and provide insight into the taxonomic and functional changes occurring in response to exercise.

Title: First, Do No Harm: The Impact of Healthcare Providers' Poor Reactions to Interpersonal Trauma Disclosure on Survivors' Willingness to Future Seek Care

Primary Author: Emily Lubin

Additional Authors: Emma Lathan-Powell;Janice Clifford;Hailie Suarez-Rivas;Hannah Sawyer;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Initial interactions with healthcare providers (HCPs) can impact how interpersonal trauma survivors engage with the healthcare system. Although survivors often report increased healthcare needs, research has found they frequently delay seeking care and report high levels of healthcare avoidance. Poor reactions to trauma disclosures from HCPs are robustly associated with patients' negative health outcomes and reduced care engagement. However, research has yet to explore whether different types of poor disclosure responses uniquely impact survivors' healthcare disclosure satisfaction and future utilization. Thus, the present study aims to investigate whether specific kinds of poor disclosure responses from HPCs predict survivors' satisfaction with the disclosure experience and their intention to utilize healthcare in the future. Undergraduate students (N = 30, 90% female, 80% White, 86.7% non-Hispanic, rangeage = 18-24 years) with a history of disclosing interpersonal trauma to an HCP completed an online survey. Participants reported the extent to which they felt blamed, ignored, judged, betrayed, or had their experience minimized by the HCP's response. They also rated their overall satisfaction with the disclosure experience, the degree to which they reduced healthcare utilization following the disclosure, and whether they would seek assistance from an HCP if victimized in the future. Ordered logistic regression analyses revealed that having one's experience minimized significantly predicted reduced healthcare utilization (β=4.275, p<.001) and reluctance to seek future care if victimized again (β=-1.96, p=.007). Findings suggest that minimization from an HCP may be a particularly harmful response to disclosure that can impact survivors' willingness to engage with the medical system, even if care is needed. HCPs may benefit from trauma-informed care training that focuses on responding more effectively to trauma disclosures without minimizing survivors' experiences.

Title: Blood serum biomarkers predict biological age in diverse mammalian species

Primary Author: Emily Marshall

Additional Authors: Christine Charvet;Ryan Gibson;Melissa Singletary;Brier Rigby Dames;Alexandra de Sousa;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Establishing the age of an organism is important for medical care and general welfare. This has far-ranging implications for wildlife conservation, livestock, companion and working animals, as animal models of human conditions for translational and aging research. Machine Learning (ML) encompasses a range of computational algorithms designed for tasks such as classification and regression, enabling applications like predicting an individual's age or identifying cancer-causing cell mutations. Blood serum biomarkers, such as alkaline phosphatase, globulin, and total protein, can be measured with minimally invasive sampling at routine healthcare checkup visits. These biomarkers can be utilized to predict age in many species due to age-related changes. The aim of this study was to utilize blood samples collected from dogs (n=266), cats (n=129), chimpanzees (n=154), macaques (n=24), and humans (n=23) to predict biological age. Data were collected from select institutions that study species of interest. Tested parameters include blood biomarkers of age (i.e., alkaline phosphatase, globulin, total protein, albumin, creatinine, sodium, chloride, and potassium) and factors such as sex and species. We assessed multiple models, including Random Forest, K-Nearest Neighbors, XGBoost, and two Gaussian Processes and used the root mean square error (RMSE) to evaluate their predictive accuracy. Preliminary results show that we were able to predict the age of dogs, cats, chimpanzees, macaques, and humans with an R-squared of 0.674. The model has a low AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion) score of 90.22 and 99.09, respectively, demonstrating a model with minimal complexity. Based on these results, these ML models utilize blood-based biomarkers to predict ages in multiple species. This technique can be employed for healthcare interventions that improve overall health outcomes and influence general welfare policies for humans and animals alike.

Title: Fundamental o Fútil? Relations Between Multiple Dimensions of Familism and Adolescent Sleep in a Hispanic Sample

Primary Author: Emily Scott

Additional Authors: Brian Gillis;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Familism, a salient cultural value, describes the prioritization of the family in daily life. Evidence supports relations of parent and adolescent familism with adolescent health behaviors like sleep, and the moderating role of adolescent familism in the context of parent factors like familism. This presentation will examine associations of parent and adolescent familism with adolescent sleep in a Hispanic sample. We utilized data from 438 Hispanic families in the Adolescent Brain Cognitive Development Study. Adolescents and their parents reported on multiple dimensions of familism utilizing the Mexican American Cultural Values Scale. Objective parameters of adolescent sleep were collected across dimensions of duration, quality, timing, and consistency. Linear multiple regression models were fit to determine the independent associations of parent and adolescent familism and their subscales with adolescent sleep, and the interaction association of Parent Familism x Adolescent Familism with adolescent sleep. Multiple dimensions of familism were associated with adolescent sleep. For example, greater adolescent overall familism and adolescent obligation were independently related to longer sleep duration. Conversely, greater adolescent referent was related to lower sleep quality, and greater parent obligation was related to less consistent sleep schedules. The interaction between parent and adolescent overall familism was not significant. Results suggest that familism is an important and nuanced factor for sleep among Hispanic adolescents. Familism may operate like a teeter totter where some dimensions may increase feelings of stress leading to worse sleep, while other dimensions may increase feelings of safety leading to better sleep. An appropriate balance of familism values may be necessary to promote optimal sleep for Hispanic adolescents. This research underscores the need for professionals to consider the importance of cultural values in health outcomes.

Title: Using habitat characteristics to predict mosquito species composition in Alabama

Primary Author: Emily Tice

Additional Authors: Janna Willoughby;Sarah Zohdy;Tabeth Mwema;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Vector-borne diseases, including those transmitted by mosquitoes, are responsible for millions of deaths annually. These diseases, including malaria, yellow fever, zika, and West Nile, are of global concern due to the increasing burden on our communities. Mosquito species of the genus Culex and Aedes are the primary vectors for these diseases, motivating increased interest in controlling the population size of these species. One factor that may influence the presence of these insects is habitat characteristics, such as proximity to water and landcover types. Here, we analyzed how different habitat components were associated with the species composition of mosquito populations, with an emphasis on mosquito species that are disease vectors. We targeted mosquitoes across six field locations in Lee County, Alabama, using CDC light traps as well as Biogent BG traps. We used two types of traps to target both day and night preferring species. In addition, we collected larvae from standing water at each site. After collection, we identified adults to genus using microscopy. We then used the program ArcGIS Pro to quantify land cover types from the NLCD (National Land Cover Database) present in the area around each of the mosquito sampling points. We considered multiple buffer sizes around each point to better understand the relationship between rare and common habitat components and mosquito presence. We also used the percent landcover in each area to statistically predict mosquito species composition and abundance. Our results aim to provide insights into how habitat composition affects the presence of different mosquito species to inform future population control decisions.

Title: When Jekylls become Hydes: unearthing the alter egos masked by social media

Primary Author: Emma Chandler

Additional Authors:

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: This study sought to identify correlations between online disinhibition and moral disengagement and their links to empathy, narcissism, and weekly total time spent on Instagram, TikTok, X, Snapchat, and Facebook in undergraduate students. Previous literature revealed many notable connections between these variables. In consideration of such literature, the following hypotheses were formed. Online disinhibition and moral disengagement would be positively correlated. Online disinhibition would be positively correlated with narcissism and social media time, and online disinhibition would be negatively correlated with empathy. Moral disengagement would be positively correlated with narcissism and social media time, and moral disengagement would be negatively correlated with empathy. To test these hypotheses, the Measure of Online Disinhibition, the Moral Disengagement Scale, the Five-Factor Narcissism Inventory – Super Short Version, and the General Empathy Scale were administered. Participants were also asked to add their total weekly screen time for Instagram, TikTok, X, Snapchat, and Facebook. Upon IRB approval, eighty-five undergraduate students from psychology, history, mathematics, and art classes were surveyed. All information gathered via packets was voluntarily and confidential. The data gathered demonstrated a positive correlation between online disinhibition and moral disengagement, online disinhibition and narcissism, and moral disengagement and narcissism. A negative correlation was demonstrated between moral disengagement and empathy, and moral disengagement and time spent on social media. No other significant correlations were found. Limitations include the homogeneity of the sample. Future researchers were advised to survey students from different types of universities.

Title: Dearomative synthesis of nitrogen and oxygen heterocycles

Primary Author: Emma Drake

Additional Authors: Agshin Garayev;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Synthesizing heterocyclic compounds is crucial for many applications, including pharmaceuticals and agrochemicals. Nitrogen and oxygen heterocycles prominently feature in many bioactive natural products and drug candidates. As an alternative to traditional cross-coupling reactions, cross-electrophile couplings do not require preparation of nucleophiles. Cross-electrophile couplings, however, suffer from a lack of product selectivity due to undesired homocoupling. Based on prior work involving nickel-catalyzed arylation of nicotinates, an efficient cross-coupling procedure of alkyl halides with azaheteroarenium salts using zinc as a terminal reductant was developed. Notably, this procedure uses blue LED light to recycle dimeric azaheteroarene intermediates, increasing yields of desired alkylated product. Radical clock studies, comparison with organozinc reagents, and isomerization of diastereomers indicate a probable radical mechanism, with additional support provided via computational methods. The reaction tolerates a wide range of functional groups and can be utilized for a variety of azaheteroarenium salts, including pyridinium, isoquinolinium, and quinolinium substrates. Given the robustness of this procedure, the alkylation of unsubstituted pyrylium salts to access functionalized oxygen heterocycles was then investigated. The optimized reaction uses an excess of zinc and various benzyl bromides to selectively generate 4-benzyl pyran products, which have previously only been synthesized using sensitive organometallic nucleophiles. Products were characterized after hydrogenation as 4-benzyl tetrahydropyrans, with other functionalization options under current investigation. The reaction tolerates a variety of electronic and steric substitutions on the benzyl ring and remarkably does not require blue LED to proceed due to lack of pyran homocoupling.

Title: AAV-mediated Anti-hormone Antibody Therapy as a Treatment for Alzheimer's Disease

Primary Author: Emma Hruska

Additional Authors: Douglas Martin;Henry Baker;Miranda Reed;Aime Johnson;Arthur Zimmerman;Gabrielle Schultz;Johanna Ehrhardt;Malia Walton;Anniston Dodson;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Alzheimer's disease (AD) is the most common form of dementia. It is marked by abnormal accumulation of beta-amyloid proteins and the hyperphosphorylation of tau proteins that together lead to neuronal degeneration. It is estimated that in 2024, 6.9 million Americans aged 65 and older had AD. Additionally, at age 45, the lifetime risk for AD among women is 1 in 5 compared to 1 in 10 for men, and evidence suggests that menopause is a clear driver for AD development. During this period, luteinizing hormone (LH) levels change due to a lack of estrogen, and previous studies have implicated altered LH levels as a potential factor for AD development. Thus, we hypothesize that increased LH levels may contribute to the neuropathology and memory loss associated with AD. To test this, we used an adeno-associated virus (AAV)-mediated anti-LH antibody treatment in APP/PS1 mice, a model of AD. We examined changes in estrous cyclicity, LH levels, and memory and learning behavior. Here, we report that treatment with anti-LH antibodies significantly disrupts estrous cyclicity, specifically leading to an increased time spent in estrus, and lowers LH levels 6-9 months post-treatment. Additionally, treated APP/PS1 mice appear to show improvement in a food choice test that measures social transmission of food preference (STFP), a behavior that deteriorates with neurodegeneration. Overall, AAV-mediated antibody treatments appear to not only disrupt estrous cyclicity likely due to alterations in LH levels, but also restore learning and memory performance during STFP.

Title: Evaluating the External Factors that Affect Specific Gravity in Longleaf Pine

Primary Author: Emma Schopen

Additional Authors: Georgios Arseniou;Zhaofei Fan;Brian Via;Haomin Huang;Favour Onyido;Jose Febles Diaz;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: As carbon markets grow, accurate and efficient methodologies to measure carbon storage in trees are needed. Above ground biomass (AGB) of a tree is often used to estimate carbon storage by multiplying a constant (i.e., 0.5). AGB is traditionally quantified through destructive sampling which requires significant time and resources. An alternative is to use specific gravity (SG) (better known as wood density) as a carbon indicator since the higher the SG the more carbon is in the tree for its volume. Yet, researchers warned that published SG values may be inaccurate since they don't accommodate influencing external factors. In this study, we quantified and evaluated the different external factors (precipitation and clay content) that could influence the SG in Longleaf Pine (Pinus palustris) trees. The SG was calculated using 146 wood core samples from Desoto National Forest, Tuskegee National Forest and forests scattered throughout Florida. The yearly average precipitation from July-September data from National Oceanic and Atmospheric Administration (NOAA) was used to represent precipitation while the percentage of clay in the soil profile from 0-200 cm from the SURGO database was used to represent clay content. A multivariable model was chosen to quantify the relationship. We found that precipitation had a significant effect on SG. For every 1 kg/m^2 of precipitation increase, the Longleaf Pine SG also increases .007 units (p value=.0005, R^2=.18). The clay content and a ratio between precipitation and clay had no significant effects on SG.

Title: Seedling susceptibility of different loblolly pine families to Lecanosticta acicola

Primary Author: Emmanuel Nyarko

Additional Authors: Annakay Abrahams;Brian Via;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Loblolly pine (Pinus taeda L.) is the most abundant pine found in Alabama. This is a result of its fast-growing nature which makes it preferred for cultivation. It thrives in a wide range of habitats, from moist, poorly drained flood plains to drier, well-drained upland slopes. The wood of loblolly pine is used for lumber, construction timbers, pulps and plywood. Hence, it has a very high economic value in the southeastern U.S. The species has been faced with needle blight diseases in the past decade. The Brown Spot Needle Blight (BSNB) fungus, Lecanosticta acicola, is known to cause severe diseases in the species. Infected pine trees may shed their needles prematurely, leading to defoliation, reduced tree growth, and premature death of trees in severe cases. While considerable research has been conducted on brown spot needle blight, there are still some knowledge gaps that need further investigation. This study seeks to determine whether different genetic families of loblolly pine have varying tolerance to brown spot needle blight. Seedlings from seventeen loblolly pine families were obtained from IFCO, Westervelt, and Aborgen in January 2024. After the seedlings were potted in peat soil and maintained under shade to acclimatize to the environment, initial measurements of height and root collar diameter were taken on all seedlings after which they were deployed to the study sites. Monthly measurements of height, root collar diameter (RCD), disease rating, and relative water content (RWC) were taken to assess their growth performance. The seedlings showed varying symptoms of brown spot needle blight, with seedlings in the infected plots having more severe symptoms than those kept under a more controlled environment.

Title: The epigenetic footprint of sleep timing in children

Primary Author: Erika Richter

Additional Authors: Geetha Thangiah;Ramesh Jeganathan;Roberto Molinari;Ukamaka Victoria Nnyaba;Yagmur Yavuz Ozdemir;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: As pediatric obesity continues to rise worldwide, it is increasingly imperative to investigate how environmental and behavioral factors, such as sleep timing, shape the epigenetic regulation of children's health. This study examines the relationship between bedtime and DNA methylation patterns in children aged 6 to 10 years old. Participants were categorized into early and late bedtime groups, and their anthropometric measurements, including body mass index (BMI), waist circumference (WC), and waist-to-height ratio (WHtr), were recorded. DNA methylation in saliva samples was analyzed using the Illumina Infinium MethylationEPIC BeadChip. This analysis identified specific genomic loci, which we refer to as target IDs, where methylation levels varied in association with different sleep schedules. These target IDs represent significant regions of the genome where we observed changes in DNA methylation linked to sleep timing. The results of this study revealed that children with later bedtimes exhibited higher BMI and anthropometric measurements, although these differences were not statistically significant. Using the Sparse Wrapper Algorithm (SWAG) analysis, we identified 1,006 significant target IDs, with 840 displaying differential DNA methylation patterns between early and late sleepers. These loci corresponded to 571 unique genes implicated in key biological processes such as metabolism, growth, and stress response. Pathway enrichment analysis revealed significant associations with circadian entrainment, glutamatergic and dopaminergic synapses, and DNA repair regulation. Furthermore, disease association analysis linked these genes to pathways involved in growth, cognitive function, and immune system regulation. These findings underscore the critical role of sleep timing in shaping the epigenome, suggesting that delayed sleep time may disrupt essential biological pathways, potentially influencing long-term health outcomes. Conclusively, further research is needed to investigate the interplay of lifestyle and environmental factors in the reversibility and clinical significance of these epigenetic modifications.

Title: Develop Rectangular Rapid Flashing Beacon (RRFB) supplementary strategies for improving pedestrian safety

Primary Author: Ernest Nsong Asiedu

Additional Authors: Ella Fife;Md Roknuzzaman;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Rectangular rapid-flashing beacons (RRFBs) have proven effective in improving pedestrian safety at crosswalks, with post-installation yielding rates ranging from 31% to 100% across 64 different sites. However, variations in these yielding rates across study sites suggest that geometric features surrounding RRFB-equipped crosswalks may influence driver yielding behavior. This study evaluates the impact of key geometric features—such as lane width, number of lanes, speed limit, road surface grade and to include the proximity to access points, the placement and orientation of RRFBs—on driver yielding behavior. Yielding is categorized into three behaviors: (1) vehicles slowing without stopping, (2) vehicles stopping completely, and (3) vehicles not stopping. Geometric features are selected based on previous research and recommendations from the Federal Highway Administration (FHWA) for the adoption and use of RRFBs. Data will be collected from eight sites in Auburn, Alabama, where RRFBs are installed near university areas with diverse geometric characteristics. Additionally, data from other previous studies will be incorporated into the analysis by utilizing Google Maps Street View, which allows for the examination of historical imagery to assess the geometric conditions presented during those studies. Statistical models of multiple regression and random forest will be employed to predict yield. The findings from this study will provide additional insights into other geometric features that most significantly influence driver yielding behavior and add to the existing FHWA guidelines for RRFB implementation. Furthermore, these results will inform future research aimed at developing supplemental strategies to enhance safety for both drivers and pedestrians at RRFB-equipped crosswalks while maintaining a high driver yielding rate

Title: Evaluating Nutritional Management in a Newly Established Peach Orchard

Primary Author: Erwin Burgos

Additional Authors: Bernardo Chaves-Cordoba;Edgar Vinson;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Fertilization guidelines for peach orchards have been questioned due to rising fertilizer costs, nitrate leaching, excessive vegetative growth, and reduced fruit quality. Current recommendations, established decades ago, suggest applying 67.25–78.5 kg N/ha but do not account for site-specific conditions, climate variability, or production goals. To assess the effects of fertilization and irrigation on peach growth and nutrition, a new orchard with 216 trees was established in Clanton, Alabama, using 'AugustPrince', 'FirePrince', and 'RubyPrince' grafted onto Guardian rootstock. Treatments included three fertilization levels (0, 50, and 100% of guideline rates) and irrigation on half the trees. Results indicate that irrigated trees exhibited significantly greater height and diameter growth, with 100% and 50% fertilization yielding similar diameters. CO_2 assimilation was highest in July, correlating with higher precipitation, while June's lower rainfall limited assimilation. Nitrogen analysis confirmed that unfertilized trees were deficient, as were some irrigated trees at 50% fertilization. Terminal shoot length showed no response to irrigation, and 50% and 100% fertilization resulted in comparable shoot lengths, with 'RubyPrince' producing the longest shoots. Since this study was conducted in a young orchard, fruit yield, and quality data will need to be assessed in future seasons to refine fertilizer recommendations more precisely. These findings suggest that reducing fertilization rates, particularly under irrigation, may be feasible without compromising growth.

Title: Acculturative Stress Caused by Uncertain Future Opportunity by Duration of Visa Status Process

Primary Author: Esther Kim

Additional Authors:

Department/Program: Communication and Journalism

College: College of Liberal Arts

Abstract: Acculturative stress is caused by new academic settings, adjustment due to cultural differences, overcoming language barriers, managing financial burdens, and uncertain future opportunity due to visa status while pursuing higher education in the United States. However, the findings suggest that visa status anxiety is one of the most significant factors impacting international students' decisions regarding their post-graduation lives (Chen, 2024). Understanding the legal processes international students must navigate, the actions they need to take, and how they perceive these challenges is essential for their mental health as these processes are often unfamiliar and complex. Moreover, among various factors, numerous studies (Sun et al., 2016) have identified social support as a crucial element in reducing acculturative stress. Therefore, I aim to investigate how the preparation and duration of transitioning from an F-1 visa to an H-1B visa, including the process of obtaining visa sponsorship from employers and government approval, influences international students' acculturative stress. Additionally, I plan to propose recommendations for enhancing social support within U.S. institutions, with a particular focus on Auburn University. This research aims to observe how acculturative stress affects international students, with a particular focus on undergraduate students who come directly from their home countries without prior experience studying abroad. This research will examine how social support can help international students manage acculturative stress related to visa status and utilize available resources to maintain mental well-being.

Title: Impact of secondary positions on injury rates in youth and high school pitchers

Primary Author: Ethan Kohler

Additional Authors: Gretchen Oliver;Billy Lozowski;Anthony Fava;Ryan Zappa;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Though it is known that baseball athletes who play the position of both pitcher and catcher are at 2.9 times higher risk of injury, it is unknown if a pitcher playing multiple positions outside of catching also increases the relative risk of throwing-related injury. While restrictions on pitch counts and innings pitched have been established, evaluating pitchers based on the number/type of positions they play may be another criterion for preventing injuries. The purpose of this study was to analyze the frequency of injuries in pitchers who play multiple positions. 190 youth and high school pitchers (1.63 ± 0.16m, 58.2 ± 16.0 kg, 13 ± 2 yrs) completed a health history questionnaire that included questions about positions played, injury history (yes/no), and current pain status (yes/no). Participants were excluded if any of the questions of interest were incomplete. After grouping participants by their secondary position(s), injury status (pain presence or surgery related to baseball) was compared with a chi-squared test ($\alpha = .05$). Statistical analysis showed no significant association between secondary positions and injury ($\chi2(12) = 9.85$, $p = .629$). Players who only pitched had a 21.4% chance of injury, while pitchers who also played catcher had a 37.5% chance of injury. All remaining groups had injury prevalences between 0% and 20%, except one group, with a sample size of 2 comprised of participants who played pitcher, catcher, and middle infield and had an injury prevalence of 50%. Although no differences were found between secondary positions played and injury rates in youth and high school pitchers, playing multiple positions appeared to decrease injury frequency. The only exception is pitchers also playing the position of catcher. One might conclude that in an attempt to mitigate injury, youth and high school pitchers should play more than one position, though preferably not the catcher position.

Title: Characterization and Optimization of Mechanical Properties of 3D Printed Components for Military Applications

Primary Author: Evan Pollard

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract:

Title: The Relationship between Trait Worry and Cognitive Impairment: Preliminary Results

Primary Author: Faith Miller

Additional Authors: Rebecca Dunterman;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Anxiety and age-related cognitive decline have a high comorbidity rate. Insufficient research examines the relationship between anxiety symptoms and cognitive performance. This study investigated the relationship between worry scores on the Penn State Worry Questionnaire and performance on the Montreal Cognitive Assessment (MoCA) and other cognitive assessments across the adult lifespan to assess if worry affects cognitive decline. Twenty-six healthy adults aged 18-73 completed the Penn State Worry Questionnaire and a battery of cognitive assessments including the Prospective and Retrospective Memory Questionnaire, Grit Scale, MoCA, Connections Test, and Digit Span Task. It was hypothesized that MoCA performance would decline with age, and there would be an inverted u-shaped relationship between PSWQ scores and MoCA scores revealing peak performance at low-to-moderate worry levels. We observed typical age-related declines in processing speed and cognitive flexibility but not in performance on the MoCA. Worry levels also significantly decreased with age. However, worry did not relate to MoCA scores, and age and worry did not interact to influence MoCA scores. Increased worry was associated with faster processing speed, but this relationship was no longer significant after controlling for age. These findings might be due to the fact that lower levels of worry in older adults masked the effects of worry on cognitive performance. These results show that older adults experience slower processing speed and reduced cognitive flexibility, which are important abilities for performing daily self-care activities like cooking and driving. These declines may prevent older adults from living independently and may be linked to mood disorders. Future research should evaluate how to improve these functions to mitigate age-related decline.

Title: Design and Development of Novel LXR beta Agonist for Alzheimers Disease

Primary Author: Fajar Setyo Wibowo

Additional Authors: Rajesh Amin;Forrest Smith;Meenakshi Singh;Nicholas Crall;Sampada Tamhankar;Ian Steinke;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Liver X receptors (LXRs) are nuclear receptors that act as transcription factors and respond to lipids. They exist in two isoforms in the body, LXRα, and LXRβ, and are mainly found in the liver and brain. LXRα is more abundant in the liver than LXRβ, while LXRβ is five times more abundant in the brain than LXRα. LXR agonists are known for their ability to treat atherosclerosis by increasing the cholesterol efflux transporters ABCA1 and ABCG1, which are associated with reverse cholesterol transport (RCT) from macrophages. However, current LXR pan-agonists (GW3965) have been shown to increase liver and plasma triglycerides and Low-Density Lipoprotein (LDL). Previous reports have indicated that LXR plays a significant role in the brain by lipidating ApoE and forming the ApoE-Aβ complex, which helps clear Aβ from the brain. Our objective is to create novel LXRβ agonists that target the brain without causing liver steatosis. To validate LXR activity, we conducted a lipid accumulation assay in HEPG2 cells using LXR pan-agonist (GW3965). Compared to the control, GW3965 showed an increase in lipid accumulation in HEPG2 cells. We designed our lead compound, AU-404LA, computationally with an emphasis on ADME. Our in-silico design was based on reducing interactions with the AF2 binding domain (His-421, Trp-443 in LXRα and His-435, Trp-457 in LXRβ), which are responsible for full activation. According to the docking score, AU-404LA has a higher affinity for LXRβ (-10.679) than LXRα (-7.644), compared to the full agonist GW3965, which has a docking score of -15.424 (LXRβ) and -14.588 (LXRα). AU-404LA and a few derivatives have been obtained. Our findings indicate that selective LXRβ targeting can prevent the adverse effects of current LXR agonists, proven by lipid accumulation assay with AU-404LA treatment and LXRβ activation using luciferase promoter assays. We plan to evaluate and examine our compound's interactions bound to the LXR receptor using crystal structure analysis.

Title: Autonomous robotic navigation in ornamental crop production using vision and sensor fusion

Primary Author: Faraz Ahmad

Additional Authors: Hamid Syed;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The ornamental crop production sector heavily relies on skilled labor for tasks such as inventory management, disease and pest scouting, plant placement, harvesting, and transportation, which collectively account for approximately 35% of total production costs. Rising labor expenses, with U.S. nursery labor costs increasing by 170% since 2007, coupled with a growing shortage of skilled workers, have created significant challenges in maintaining operational efficiency and scalability. To address these challenges, substantial research and development efforts are focused on automating key production processes, including planting, placement, quality assessment, inventory tracking, and disease and pest scouting, through the integration of robotic platforms. For these robotic platforms to operate autonomously, the development of a robust autonomous navigation system is critical. This research project aims to design and implement an autonomous navigation system capable of reliable and precise movement in these settings. A simulation environment was first developed using Gazebo and ROS to replicate nursery conditions, enabling efficient testing and optimization of navigation algorithms. Subsequently, the system was transferred to a physical robot, leveraging RGB and depth data from a ZED camera to train deep learning models for detecting nursery bed spacing. High-accuracy bed spacing detection was achieved through Panoptic Segmentation (Detectron2) and Instance Segmentation (YOLO), with performance benchmarks against traditional computer vision methods such as contour detection, edge detection, RANSAC, and least squares. Sensor fusion integrated ultrasonic sensor measurements with vision-based navigation data using mean and Kalman filters, while GPS and visual odometry fused with IMU data supported inter-row and local navigation, respectively. Motion control strategies, including Pure Pursuit, PID, and Point-to-Point algorithms, were employed to optimize robotic path-following and angular velocity control. This autonomous robotic navigation system holds significant potential to reduce labor dependency, streamline nursery operations, and enhance operational efficiency under diverse environmental conditions.

Title: /Blend(ing) Industrial Intelligence: Infrastructures and Stories

Primary Author: Fiona Content

Additional Authors: Eilis Finnegan;

Department/Program: School of Architecture

College: College of Architecture, Design and Construction

Abstract: Title: /Blend(ing) Industrial Intelligence: Infrastructures and Stories Primary Author: Content, Fiona R. Additional Authors: Finnegan, Eilis Department/Program: Environmental Design College/School: Auburn University College of Architecture, Design and Construction Abstract: /Blend(ing) Industrial Intelligence: Infrastructures and Stories is a creative research project exploring generative AI (GENAI) software for speculative architectural design. It investigates how image-to-image pixel coding (Midjourney.ai), image-to-mesh modeling (Meshy.ai), and mesh-to-3D printing (Bambu Lab) can hybridize architectural tropes and geometric languages — workflows engaging with contemporary AI-assisted architectural design research and practice. This research examines GENAI's role in representing and fabricating speculative proposals, focusing on rural industrial systems that merge high-tech and low-tech interfaces, adaptive technologies, and the folklore embedded in community-based infrastructures. Prototypes such as Stills for Shadows and Spirits, an Observatory for Ominous Operations, and a Turbine for Tracking and Transmissions speculate on architectural memory, machine hallucinations, and uncanny forms. These designs reimagine silos as hybrid stills, observation towers fused with drone tech, and wind turbines repurposed for recording. A series of renderings and 3D-printed constructs highlight these hybrid forms, contributing to an informational booklet documenting generative computation in spatial design. The booklet features a taxonomic arrangement of images and mesh forms, with citations linking sourced and original content—acting as a kind of artifact DNA through computational iterations. The project explores "phygital" design—the fusion of physical and digital artifacts—while assessing GENAI's viability in speculative architecture and design research.

Title: The connection between pre-anesthesia blood pressure and post-anesthesia complications

Primary Author: Fiona Washburn

Additional Authors:

Department/Program: Nursing

College: College of Nursing

Abstract: Post-surgical complications can delay the recovery process and, in severe cases, cause death. Healthcare providers complete pre-surgical assessments to decrease the risk of post-operative complications. Pre-operative assessment includes medical/surgical history, vital signs, and a physical assessment. Anesthesia providers complete a pre-anesthesia assessment that reviews possible complications or identifies risk factors. Often, this pre-anesthesia assessment is completed up to a week before surgery. Blood pressure is impacted during surgery due to its involvement with the autonomic nervous system and is not routinely reviewed in the pre-anesthesia assessment. A pre-intubation abnormal blood pressure correlates to an abnormal blood pressure during surgery, which can increase the incidence of postoperative complications. The purpose of this literature review is to explore the correlation between pre-intubation blood pressure and the risk of post-procedure outcomes. Specifically, this review will help to evaluate standard protocols and identify best practices for the anesthesia pre-operative assessment.

Title: Investigating consumer perceptions towards apparel made of recycled polyester fabric

Primary Author: FNU Al-Amin

Additional Authors: Amrut Sadachar;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This study investigates consumer attitudes and purchase intentions toward apparel made from recycled polyester fabric, examining key moderating factors (i.e., need for uniqueness, fashion consciousness, environmental consciousness, and age) to understand the drivers behind sustainable fashion consumption. Grounded in Homer and Kahle's Value-Attitude-Behavior (VAB) model, the research analyzes how perceived values—functional, economic, emotional, and social—shape consumer attitudes, which in turn influence their purchase intentions. The primary objective was to explore how these perceived values interact with individual consumer traits to impact attitudes toward such apparel. Applying Constructive Controversy, this study captures both favorable and opposing perspectives on sustainable fashion, offering insights into consumer conflicts when evaluating recycled polyester. Data were collected through an online survey with 285 participants across various age groups, utilizing quota sampling for representativeness. The results reveal that functional, economic, and emotional values significantly enhance consumer attitudes toward recycled polyester apparel, while social value does not. Furthermore, attitude influenced purchase intention toward apparel made from recycled polyester fabric. Additionally, the hypothesized moderating effects of the personal characteristics of consumers aside from age, significantly moderated the attitude-purchase intention relationship. These findings enhance the VAB model by integrating consumer attributes as moderators and suggest that marketers should highlight recycled polyester apparel's benefits while tailoring strategies to individual traits to boost adoption.

Title: Investigating the performance of recently released rabbiteye blueberry (Vaccinium virgatum Aiton) cultivars for sustainable production in Alabama

Primary Author: FNU Jagjit Singh

Additional Authors: Bernardo Chaves-Cordoba;Edgar Vinson;Marlee Trandel;Melba Salazar-Gutierrez;Elina Coneva;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Blueberry acreage in Alabama has experienced a 37% increase over the last 15 years, demonstrating a considerable industry growth. New rabbiteye blueberry cultivars with improved fruit quality attributes have been recently released. However, very limited information is available on their performance in Alabama conditions. This study aims to evaluate the overall horticultural performance of the recently released rabbiteye blueberry cultivars ‘Alapaha’, ‘Krewer’, ‘Ochlockonee’, ‘Pink Lemonade’, ‘Titan’, and ‘Vernon’ and compare their productivity and fruit quality attributes to the established cultivars ‘Climax’, ‘Powderblue’, ‘Premier’ and ‘Tifblue’. An experimental plot was established at the Chilton Research and Extension Center, Clanton, AL in 2019 and a RCBD with four blocks was utilized. The 2024 results suggest ‘Pink Lemonade’, ‘Alapaha’, ‘Krewer’, ‘Climax’, ‘Vernon’ and ‘Premier’ ripened early in the season, whereas ‘Tifblue’ and ‘Titan’ had mid-season ripening. Berries of ‘Ochlokonee’ and ‘Powderblue’ matured late in the season. ‘Ochlockonee’ produced the highest total yield of 5.6 kg/plant followed by ‘Vernon’ with 5.1 kg/plant, while ‘Pink Lemonade’ had the lowest yield of 0.98 kg/plant. ‘Climax’ produced the sweetest berries with a TSS of 16.00 Brix, while ‘Titan’ had the highest flesh firmness. ‘Titan’ also produced the largest individual berry size (3.2 g), whereas ‘Alapaha’ had the smallest individual berry weight of 1.3 g. The outcomes of this study can aid in determining the most suitable rabbiteye blueberry cultivars for production under Alabama conditions and can help sustain rabbiteye production in the Southeast.

Title: New age sustainable vegan fashion drivers and barriers

Primary Author: Fnu Parul

Additional Authors: Angie Lee;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: In response to rising consumer animal welfare concerns, the fashion industry has adopted petroleum-based synthetic vegan materials, which are non-biodegradable and unsustainable. Recently, researchers have developed plant-based (e.g., pineapple) and bio-based (e.g., fungus) alternatives that are either semi or fully biodegradable, collectively called new-age sustainable vegan fashion [NASVF] materials in this study. Luxury and mass fashion brands' growing interest in NASVF materials makes it crucial to explore consumer perceptions to develop and promote them effectively. Yet, it remains unexplored in the current literature. First, this study bridges a gap in the literature by addressing inconsistencies in defining vegan fashion. Existing literature uses the term 'vegan fashion' with no clear distinction between synthetic vegan and NASVF materials. This variation may confuse consumers, emphasizing the need for conceptual clarity of 'vegan fashion' from their perspectives to ensure a more consistent and accurate understanding. Second, this study further examines their awareness of NASVF alternatives and how they position these options within the broader concept of vegan fashion. Finally, while fashion brands are increasingly using NASVF alternatives, the factors influencing consumer adoption remain unclear. Therefore, this study examines the key drivers and barriers affecting consumer adoption. Using a grounded theory approach, interviews will capture raw insights from a sample of Gen Z and Millennials, as they are open to innovation and consider sustainability more important than other generations. Thematic analysis will be used to analyze the data. The findings will help uncover previously overlooked drivers and barriers specific to the context of NASVF alternatives. Thus, this study will guide manufacturers and brands to align the NASVF materials and product offerings with consumer expectations and market them to address any misconceptions that may hinder adoption.

Title: Engineering Liquid Crystal Self-Assembly in Aqueous MXene-Cellulose Nanocrystal Mixtures

Primary Author: Francis Mekunye

Additional Authors: Virginia Davis;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: This study investigated the phase behavior of aqueous dispersions containing 2D MXenes and 1D sulfated cellulose nanocrystals (CNCs). MXenes are a rapidly emerging class of 2D materials with an unusual combination of conductivity, hydrophilicity, high surface area, and electrochemical activity, making them highly desirable for energy storage and sensing applications. In contrast, CNCs are widely recognized for their exceptional mechanical strength and their applications in optical and photonic films. Despite their individual significance, limited research has explored combining self-assembly behavior to create novel hybrid materials with emergent structural and functional properties. The CNCs used in this research were extracted from wood biomass using sulfuric acid hydrolysis. These CNC are short rod-like nanocrystals, with lengths below 0.2 µm and diameters around 10 nm, while MXene nanosheets exhibit lateral dimensions ranging from 0.3 µm to 3 µm but are less than 1 nm thick. A central question in this research was determining the conditions under which the nematic phase behavior characteristic of MXene dispersions would dominate over the cholesteric phase behavior typically exhibited by sulfated CNC dispersions, particularly given their discrepancies in sizes. The results showed that even at low concentrations, the larger MXenes induced nematic phase formation in CNC dispersions near the isotropic-nematic transition. In contrast, mixtures of smaller MXene nanosheets with CNCs at comparable volume fractions displayed a cholesteric microstructure. Interestingly, at certain concentrations, both cholesteric fingerprints and bright purple nematic textures were observed simultaneously. These findings highlight the ability to tune and control liquid crystal microstructures, offering a strategy for directing both orientational and spatial orientation at the nano-to-mesoscale, enabling new opportunities in optoelectronics and energy storage applications.

Title: Algal Systems in Aquaculture: A review of experimental designs in wastewater treatment using filamentous algae

Primary Author: Gabriel Proano Pena

Additional Authors: David Blersch;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Wastewater treatment is one of the ongoing post-processes that the aquaculture industry must manage as part of its routine practices. This aspect requires continuous attention due to the reinforcement of regulations to protect environmental quality. Algae cultivation systems have provided proven and sustainable solutions in various aquaculture applications to meet these ongoing demands. For example, they serve as feedstock for juvenile shrimp cultivation and act as a natural oxygen supplier in fish farming. This work aims to review the state-of-the-art applications of algae systems in the aquaculture industry, emphasizing their benefits for wastewater treatment. The effectiveness of algae systems has been maximized when deployed as filamentous algae cultivation systems such as the Algal Turf Scrubbers (ATS). This technology can remove nutrients from water streams and, in some cases, serve as a more effective alternative to traditional filtration systems. The introduction of ATS in aquaculture has been demonstrated not only in fish farming with species such as tilapia and catfish but also in oyster cultivation. Despite these field applications, developing a reproducible method for monitoring ATS performance remains an ongoing challenge. This review will focus on the need and opportunities for the application and improvement of ATS systems for aquaculture wastewater remediation. It also will explore the experimental approaches for replicated experimental investigations using novel approaches for formulating synthetic fish wastewater to fill that experimental need.

Title: Enhancing consumer perceptions of beef sustainability through science-based infographics

Primary Author: Gabriella Johnson

Additional Authors: David Martin;Jason Sawyer;Donald Mulvaney;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Understanding consumer perceptions of sustainability in beef production is critical for informed industry decision-making in production, marketing, and advocacy. This study examined the effectiveness of infographics as a science communication tool to address misinformation and shape consumer opinions on beef sustainability. Infographics simplify complex information, reducing cognitive load and enhancing message retention, yet their application in agricultural communication remains underexplored. A survey assessed participants' baseline knowledge, sustainability priorities, and beef purchasing behaviors. After exposure to three infographics, respondents were reassessed, revealing significant increases in self-reported knowledge ($p < .001$) and more favorable perceptions of sustainability in beef production ($p < .001$). However, skepticism remained regarding hormone use and data representation. Future research should refine infographic design by narrowing content focus and incorporating interactive elements to optimize engagement and comprehension in science communication efforts.

Title: Regulation of luteinizing hormone as an alternative to traditional spay/neuter.

Primary Author: Gabrielle Schultz

Additional Authors: Aime Johnson;Arthur Zimmerman;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: In the United States, the primary method of companion animal sterilization is spay/neuter; however, there are long-term implications of these procedures, such as increased risk of Feline Cognitive Dysfunction (FCD), Canine Cognitive Dysfunction (CCD), obesity, hypothyroidism, urinary incontinence, and other physiological conditions. Therefore, there is a critical need for alternative methods to traditional spay/neuter to decrease the long-term side effects associated with these surgeries. Removal of the male and female gonadal organs leads to dysfunction of the hypothalamic-pituitary-gonadal axis and interrupts the associated hormonal feedback mechanisms. Luteinizing hormone (LH), which is released from the anterior pituitary gland, is closely regulated by negative feedback mechanisms from both estrogen and testosterone; thus, the removal of the gonadal organs leads to high levels of LH which can cause serious, long-term side effects. Because of this, our work aimed to identify an alternative method of traditional spay and neuter by altering levels of LH through an AAV-mediated antibody gene therapy. In this study, CD1 mice were treated with two variations of an anti-LH AAV antibody that both recognized different LH β-subunit epitopes. We collected blood biweekly to measure LH serum levels, tracked estrous cyclicity daily and performed mating studies to determine reproductive success. Both treatment groups spent a longer percentage of time in the estrus phase of estrous cycle compared to the control group. In addition, both treatment groups had lower LH in their serum by 16 weeks post-treatment. While mating and pup average weights remained the same across all treatments, the litter size in group 1A4H3 had more variability. Although fertility appeared to be unaffected, future studies will be aimed at examining dose-dependent effects as well as ways to refine and determine the efficacy of this innovative, non-surgical approach to traditional spay/neuter.

Title: Reclamation and characterization of polyolefins from multilayer plastic packaging waste

Primary Author: Garrison Sharp

Additional Authors: Ke Zhan;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Multilayer plastic packaging (MPP) is known for its durability, barrier properties, and flexibility, making it a leading material choice in the food packaging industry. Due to the chemical structure differences among layers in MPP, conventional mechanical recycling is inappropriate, causing valuable materials to be incinerated or landfilled, which leads to resource waste, economic loss, and ecological nuisance. The objective of this research was to develop a simple method for reclaiming polyolefins from MPP and characterize their mechanical properties. A low-density polyethylene (LDPE)-based MPP, combining ethylene vinyl alcohol (EVOH) as the barrier layer and maleic anhydride-grafted linear LDPE as the adhesive layer, was used in this study, with formic acid serving as the main solvent for dissolution experiments. EVOH was successfully dissolved, and the LDPE was reclaimed through a simple filtration step. Several dissolution parameters, including sample surface area, solvent-to-sample ratio, stir bar size, and stir speed, were evaluated, and an optimized condition was applied to conduct a pilot-scale dissolution, yielding sufficient polyolefins for mechanical characterization. The mechanical results showed that the dissolution process had a negligible impact on the properties of LDPE. This simple selective dissolution method presents a promising and scalable solution for recycling MPP.

Title: Harnessing drought-tolerant plant growth promoting rhizobacteria for effective management of Meloidogyne Incognita in cotton

Primary Author: Gayatri Bhandari

Additional Authors: Kathy Lawrence;Bisho Lawaju;Prativa Chhetri;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Cotton (Gossypium hirsutum) production is severely impacted by Meloidogyne incognita (root-knot nematode, RKN), imposing significant root damage and yield losses. While chemical nematicides offer effective control, their environmental risks and economic burden necessitate sustainable alternatives. This study evaluates drought-tolerant plant growth-promoting rhizobacteria (DT-PGPR) for their potential in nematode suppression and plant growth enhancement, focusing on nitrogen fixation, siderophore production, and nematicidal activity. Nitrogen fixation was assessed using JNFb media, with 25% of strains exhibiting significant nitrogenase activity. The most efficient strains included Promicromonospora alba (DT-15), Pseudomonas oryzihabitans/psychrotolerans (DT- 49), Bacillus amyloliquefaciens/siamensis (DT-87) and Pseudomonas atacamensis (DT-153). Siderophore production, crucial for iron acquisition and microbial competitiveness, was evaluated on CAS agar media, identifying Fictibacillus phosphorivorans (DT-187), Variovorax paradoxus (DT-103), Pseudomonas caricapapayae (DT-223), and Sphingomonas endophytica (DT-53) as high producers. Nematode suppression was tested using 190 bacterial strains against M. incognita second-stage juveniles (J2) in 96-well plates, with NaOH viability assays after 48 hours. Chryseobacterium elymi (DT-3, 36%), Sphingomonas kyeonggiensis (DT-204, 32%), Bacillus velezensis (DT-59, 32%), and Variovorax ureilyticus (DT-64, 30%) showed the highest nematicidal activity. This study establishes a framework for selecting the most effective DT-PGPR strains for greenhouse trials to assess their impact on cotton growth and nematode control. Subsequent field trials will validate their efficacy in enhancing cotton yield and reducing nematode damage. DT-PGPR offers a sustainable alternative to chemical nematicides, integrating biological control and plant growth promotion to improve cotton production in nematode-infested regions.

Title: Comparison of the duodenal proteome profiles of broiler chickens raised on used or new litter

Primary Author: Gerardo Abascal Ponciano

Additional Authors: Jessica Starkey;Jake Keel;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Limited research has shown that litter condition can alter broiler performance. Changes in the ileal and cecal microbiota in broilers raised on used litter (UL) vs. new litter (NL) have been reported, and in our previous work more mitotically active cells were observed in the small intestine of 3, 15, and 21-d-old broilers raised on UL vs. NL. The objective of this experiment was to explore the duodenal proteomic profiles in broilers raised on NL vs. UL. A randomized complete block design experiment was conducted with broilers reared on either NL or UL for 15 d. On d 15, 6 birds per treatment from 6 different blocks (total n = 12) were randomly selected for sampling. Duodenal tissue samples were collected at 1.5 cm distal to the duodenal loop and snap-frozen in liquid nitrogen until processing. Duodenal samples were homogenized using a total protein extraction reagent and analyzed through liquid chromatography-tandem mass spectroscopy. Spectral data were processed using Proteome Discoverer software (ver. 2.5.0.400) and searched with Sequest HT and Mascot against chicken databases. Data was further processed using the Bioconductor pipeline in R (ver. 4.3.1). Proteins were considered differentially expressed (DE) with a significance threshold of ≤ 0.05 and a log2 fold change ≥ 2.0. Nine proteins met the DE criteria, all of which were upregulated in the NL treatment: AT-III, FGA, FGB (coagulation), KHK and GNPDA1 (sugar metabolism), RAB5B (endocytosis), PAFAH2 (inflammation), EPHX1 (detoxification), and AGMAT (amino acid and urea metabolism). Although immune-related proteins were DE expressed, major immune pathways such as STAT3 and MHC-I were not DE. Rearing broilers on NL vs. UL appears to upregulate proteins associated with intestinal immune modulation and other metabolic functions, providing some insight into the intestinal physiological mechanisms impacted when broiler flocks experience “new house syndrome” growth performance issues.

Title: Assessing the impact of the California cap-and-trade program on green innovation: A quasi-natural experiment

Primary Author: Ghanashyam Khanal

Additional Authors: Daowei Zhang;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: A Difference-in-Differences (DiD) approach is used to evaluate county-level data from the treated state of California and bordering control states of Arizona, Nevada and Oregon. This study evaluates the impacts of the California greenhouse gas emissions cap-and-trade program (CATP) on green technological innovation using environmental patents as a proxy for green innovation.The county-level analysis finds that the implementation of CATP has a positive and significant impact on green innovation in Californian counties than in the control group. Notably, the heterogeneity tests show that eastern Californian counties, the most populated counties, and those counties bordering Nevada have experienced the most impact from the program. Similarly, the macro-level state and city analyses show a positive and significant impact of CATP on green innovation. The results of robustness tests, including parallel trend, dynamic effect, placebo, and other contemporaneous policy effect tests further validate the reliability of our findings.

Title: Explicit and implicit gendered language in job advertisements: effect on applicant perceptions and workforce populations

Primary Author: Grace Hatfield

Additional Authors: Alejandro Lazarte;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Gendered language in job advertisements plays a crucial role in shaping applicants' perceptions and career choices. The influence of such language may subconsciously deter applicants from underrepresented groups, particularly women, from considering certain industries or positions. This phenomenon contributes to existing gender disparities in the workforce. While research has explored gender bias in hiring and gender equality has improved over the years, challenges persist. Our study investigates how gendered language in job postings affects applicants' perceptions of job suitability and their likelihood of applying. Using adjectives at the extreme ends of gender associations, we created mock job advertisements to include in a Qualtrics survey. These vignettes featured advertisements in either male- or female-dominated fields, incorporating gendered wording that was either implicitly consistent or inconsistent with the profession's typical gender association. In addition, some vignettes explicitly presented gender pronouns (she/he, her/his) in the description of the job position. Employing a quantitative approach, we randomly assigned a sample of Auburn students to one of four groups receiving vignettes with varying arrangements of gendered adjectives and pronouns. The Qualtrics survey collected demographic data and measured participants' perceptions of gender association and their subjective fit for the given position. Our preliminary results suggest that gendered language impacts both male and female participants' perception of job fit, with females particularly discouraged by male-associated phrasing. Future research will extend the study to larger samples, including current members of the workforce. Ultimately, our work aims to address workforce inequalities and promote accessibility to an expanded range of employment opportunities.

Title: Using dendrochronology to evaluate the impacts of brown spot needle blight

Primary Author: Gracey Goldsby

Additional Authors: Lori Eckhardt;Jaden King;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Lecanosticta acicola is the causal agent of brown spot needle blight (BSNB), a fungus impacting the foliage of 53 Pinus species. BSNB infection severity ranges between species, causing minimal symptoms to rapid defoliation. Specifically in loblolly pine, BSNB has been causing severe symptoms within the past 10 years, ranging from browning of needles, premature needle shed, stunted growth, and tree mortality. A dendrochronology approach can be used to understand the relationship between loblolly pine growth over time and BSNB severity. Data was collected from a 9.5 acre 26-year-old loblolly pine plantation located in Cullman, AL. Within this plot, visible symptoms of BSNB were first noticed in 2017. To capture growth change, we took year-to-year growth measurements of 312 trees, measuring 7 years before symptoms were noticed (2010-2017) and 7 years after symptoms were noticed (2017-2023). Year to year measurements were measured using a digital microscope software (AmScope). Disease rating was measured by classifying each tree into 5 categories, with 1 being minimal symptoms and 5 being almost all needles symptomatic. Our results show that most trees in the stand had a disease rating of 2 or 3, so our results were not significant ($p<0.05$) when comparing growth to disease level. For all trees regardless of disease rating, total tree growth of 7 years before (2010-2017) noticeable symptoms in 2017 were 8.18 mm (+/-0.43 ; +/- 95% CI) higher than growth rates in the 7 years after (2017-2023) disease was noticeable ($p<0.0005$). The decline in growth rates suggests that BSNB has caused negative impacts on the physiology of loblolly pine trees. Further steps include evaluating such results and determining other factors that may be influencing the growth rates of loblolly pine trees in Cullman, AL.

Title: Measuring spelling in children with and without speech sound disorder beyond whole-word accuracy

Primary Author: Gracie Hundley

Additional Authors: Dr. Anna Ehrhorn

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Children with speech sound disorder (SSD) have lower spelling accuracy than peers with typical speech development (TSD). It is unclear whether lower spelling accuracy is due to the presence of SSD and/or language ability. The present study examined spelling in children with SSD as compared to peers with TSD beyond whole-word accuracy. Exploring spelling beyond whole-word binary accuracy scoring will better understand the spelling deficits and validate other spelling analysis methods to inform intervention that supports literacy development for children with SSD. Fifty-seven monolingual English-speaking children (6-8 years old; SSD = 27 and TSD = 30) completed speech and language assessments including a 10-word spelling task. Spelling task scoring methods included three accuracy analyses and an error analysis concentrated on four types. Statistical models were conducted using both the accuracy and error scoring methods to compare groups and language ability. Results indicated that whole-word binary accuracy was the least sensitive and specific for spelling difficulties as compared to other accuracy methods, especially for children with SSD with language deficits. The error analysis results suggested that only errors related to sounds in spelling performance predicted group differences when accounting for language ability. Clinicians should consider scoring spelling accuracy using other methods than whole-word binary accuracy and incorporate the spellings of words in speech production intervention to support early literacy in SSD.

Title: Family foundations and the transfer of philanthropic values: A case study

Primary Author: Grayce Andrews

Additional Authors: Peter Weber;Audrey Burgett;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Family foundations play a crucial role in preserving and transmitting philanthropic values across generations, shaping both personal identities and broader societal contributions. Family foundations, while lacking a formal legal definition, are generally recognized as grantmaking institutions that enable families to sustain their personal philanthropic objectives. While scholarship emphasizes the importance of legacy and philanthropic impact, how foundation leadership fosters and sustains these values over time is less explored. The limited literature in this area highlights various strategies, such as structured mentorship programs, governance policies that encourage multigenerational involvement, and formalized value-driven grantmaking approaches, that help sustain philanthropic values in family foundations over time. Additionally, fostering open communication and engaging younger family members through hands-on participation further reinforces these principles. Relying on interviews with foundation leaders and staff of a family foundation that serves Lee County, this study examines the mechanisms through which family foundations instill and maintain core philanthropic principles. The interview with the local family foundation is scheduled for the last week of February, by when the IRB Exempt Protocol is expected to be approved. This study thus aims to highlight effective practices that ensure continuity of mission and purpose across generations, reinforcing the enduring influence of family foundations in an evolving world.

Title: A Comparison of Compatibilization Methods for Polyethylene and Polypropylene Blends at 2 wt% MDBS

Primary Author: Greydon Franck

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Isotactic polypropylene (iPP) and high-density polyethylene (HDPE) are two of the most widely produced polymers, with millions of tons produced each year. A large portion of this production goes into single use products producing a significant amount of waste that must be managed. Improper waste management of iPP and HDPE pose significant environmental risks. However, recycling is a viable for properly treating this waste. Because iPP and HDPE have similar densities and co-crystallize when melt blended, these two polymers present a challenge to recycling. Co-crystallization results in an inferior polymer product from melt blended recycled plastics. Compatibilization methods have been developed to attempt to obviate these challenges to recycling. Increasing the crystallinity of the iPP and PE phases can achieve desirable polymer blend characteristics. MDBS, a polypropylene additive, at 3 wt% has been shown to increase crystallinity in both the PE and iPP by preventing co-crystallization. This increase in crystallinity can be related to an observed increase in strain at break, young's modulus, and yield strength. The effect of 2 wt% MDBS on 85:15 mass ratio PE to iPP polymer blends was determined. At 2 wt% MDBS similar trends in crystallinity and tensile properties for 85:15 PE to iPP polymer blend were observed to that of 3 wt%. The effect of melt mixing MDBS into PE versus iPP was also compared. The addition of MDBS increased the overall crystallinity as well as the crystallinity of the MDBS free phase. Melt mixing MDBS into the PE before melt mixing with iPP exhibited a higher young's modulus and yield strength than melt mixing MDBS with iPP first. Both methods of preparation exhibited higher strain at break, young's modulus, yield strength, and crystallinity than 85:15 blends without MDBS.

Title: Sustainable Management Practices for Reducing Contaminant Loss in Agricultural soil

Primary Author: Gurparshad Singh Brar

Additional Authors:

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Nutrient and metal loss from agricultural fields fertilized with animal manure leads to water quality issues. Effective management strategies can help to control the loss of contaminants from croplands. Our study evaluated the impact of different poultry litter application methods along with the use of biochar on the transport processes of phosphorus and metals. The investigation utilized the flow interruption technique to assess the leaching behavior of metals and phosphorus. Column-based rainfall simulation experiments were conducted on soil cores collected from pastures. Treatments were surface-applied poultry litter, subsurface-banded poultry litter, surface-applied poultry litter + biochar, subsurface-banded poultry litter + biochar, and control (no biochar and poultry litter). Results showed that the subsurface application of poultry litter helped reduce the concentration of orthophosphate in the leachate. Further, preliminary results show that the addition of biochar helped reduce the loss of metals such as iron and aluminum.

Title: Adapting the Reconnecting to Internal Sensations and Experiences Intervention for Veterinary Students

Primary Author: Hailey Fox

Additional Authors: Hannah Sawyer;Cassidy Chesnutt;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Decades of research suggests that veterinary students and professionals are at elevated risk for suicidal thoughts and behaviors compared to other high risk occupational groups and the general population. Notably, veterinary students and professionals report stigmatizing attitudes about psychological treatment and several barriers to mental health care. The brief, online Reconnecting to Internal Sensations and Experiences (RISE) intervention (Smith et al., 2021, 2022, 2023) may be an accessible, effective treatment for improving interoception, a transdiagnostic risk factor for suicide, and reducing suicide outcomes among veterinary students and professionals. However, the feasibility and acceptability of the RISE intervention has not yet been examined in this population. Thus, the present study aims to conduct a theater test of the RISE intervention to adapt the program for a new population of veterinary students consistent with the ADAPT-ITT model (Wingood & DiClemente, 2008). Qualitative and quantitative data will be analyzed to examine overall impressions, acceptability, feasibility, and suggested modifications to the RISE intervention reported by veterinary students to adapt the program for this new population. Moreover, we will examine the psychometric properties of various self-report measures of interoception, psychological distress, and suicide ideation to determine whether these scales are appropriate for use among veterinary students. Participant engagement, attrition, and trends in interoception and suicide across the study will be described to inform future research. Adapting the RISE intervention to be suitable for veterinary students and professionals may address barriers to psychological treatment, while improving interoception and reducing suicide outcomes for these high-risk populations.

Title: Investigation of Wall Heat Transfer Effects on Solid Fuel Combustion for Aerospace Propulsion

Primary Author: Hailey Livesay

Additional Authors: James Michael;Sarang Bidwai;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Solid fuel combustion displays potential advantages for application in aerospace propulsion. Polymers, such as polyoxymethylene, have the potential to be used as a solid fuel for air-breathing rockets. Utilizing polyoxymethylene as a rocket fuel eliminates the storage of oxidizers in the rocket, due to the ability of the polymer to combust when reacted with oxygen. Polymers provide a safer alternative to solid rockets and a denser alternative to liquid rockets. To characterize the burn rate of the polymer the experiment used a simplified opposed flow burner configuration. Oxygen flowed from the burner at different velocities onto a polymer, and a stepper motor was used to maintain consistent contact between the polymer and the oxidizer. Regression rate, the measure of how quickly a fuel burns, quantifies the combustion performance of solid fuels. The regression rate of the polymer was measured by comparing the number of steps taken by the motor with the velocity of the oxidizer. Polymer is an insulating material, therefore the conductivity of the material around it affects the regression rate through heat transfer from the polymer outwards. A lower regression rate is expected for a lower protrusion of the polymer from the surrounding material due to heat loss. Variation in the heat lost to the holder of the polymer occurs when changes are made to the thermal conductivity of the holder. The configuration of the polymer was manipulated to vary the distance of the crown of the polymer to the wall of the polymer holder. The material of the holder was changed such as switching from stainless steel to ceramic. The goal of this study is to display the importance of understanding heat transfer to successfully test the regression rate of polyoxymethylene.

Title: Dysregulated: Exploring How Trauma Appraisals and Emotional Dysregulation Interact to Predict Insomnia Symptoms

Primary Author: Hailie Suarez-Rivas

Additional Authors: Emma Lathan-Powell;Hannah Sawyer;Emily Lubin;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: A survivors' trauma appraisals (e.g., shame, guilt, betrayal), or the way in which they conceptualize their trauma exposure and related symptoms, are closely linked to a variety of trauma-related outcomes. While research has identified trauma's influence on insomnia symptoms, little research has explored the role maladaptive trauma appraisals may have. One factor that may influence the potential association between maladaptive trauma appraisals and insomnia is emotion dysregulation, or the inability to control and respond adaptively to one's emotions. Emotional dysregulation has been associated with both insomnia and trauma separately. To date, no research has examined whether emotional dysregulation moderates the association between trauma appraisals and insomnia. The aim of the present study is to understand how trauma appraisal and emotion dysregulation interact to influence insomnia symptoms. Women who resided in a domestic violence shelter were recruited through an online survey ($N = 120$, 50.0% identified as White, M age = 37.3 years, SD age = 10.1). Moderation analyses revealed main effects of trauma appraisals, $B= .12$, $SE=.03$, $p < .001$, and emotion dysregulation, $B= .51$, $SE=.001$, $p=.013$, on insomnia symptoms. Further, trauma appraisals and emotion dysregulation interacted to predict insomnia symptoms, $B = -.002$, $SE = .001$, $p = .013$, specifically at low, $t = 5.43$, $p < .001$, and moderate, $t = 3.31$, $p = .001$, levels of emotion dysregulation. Findings suggest that equipping IPV survivors who have low and average levels of trauma appraisals with emotion regulation skills may help address insomnia symptoms; however, those with higher levels of trauma appraisals may require a targeted insomnia-focused intervention as emotion dysregulation was no longer a salient risk factor. Future studies may benefit from assessing multiple types of trauma and appraisals to explore how they may interact with emotion dysregulation to influence insomnia symptoms.

Title: Enhancing the Ornamental Inventory and Quality Assessment Across Diverse Growth Stages using Unsupervised Domain Adaptation

Primary Author: Hamid Syed

Additional Authors: Mohtasim Hadi Rafi;Faraz Ahmad;Jeremy Henderson;Tanzeel Rehman;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Ornamental plant nurseries contain thousands of plants across hundreds of varieties, making accurate counting and quality assessment a significant challenge. The traditional method of manually counting large quantities of plants is inefficient, time-intensive, and costly. Additionally, ornamental plants exhibit substantial variability in appearance at different growth stages, and diverse background and canopy characteristics further complicate the counting process. While advancements in deep learning, particularly image segmentation techniques, offer promising alternatives for automating plant counting. However, these methods typically require extensive labeled datasets that encompass multiple growth stages, canopy coverages, plant spacings, and other variations. This dependence on continuous data labeling limits the scalability and adaptability of such models within the ornamental industry. To address these limitations, this study proposes an approach utilizing unsupervised domain adaptation to accurately count plants at various growth stages and assess plant quality across maturity phases without the need for extensive labeling. The developed model effectively eliminates the need for the labeling process, demonstrating robust performance when tested on previously unseen data from different plant classes. The results demonstrate that the model can accurately segment and count plants with performance comparable to models trained on labeled data, while significantly reducing the need for repeated labeling. This offers a more efficient and scalable solution for plant nurseries. In addition, the model's ability to generalize across various plant growth stages underscores its potential for broader applications in agricultural automation and smart farming. In pioneering plant management methods, this approach leverages unsupervised domain adaptation to minimize manual intervention and enhance operational efficiency, demonstrating the practical application of advanced deep learning models in ornamental nurseries

Title: Development of eco-friendly biolubricants from waste cooking oil using a novel cascade catalytic process

Primary Author: Hanieh Najafi

Additional Authors: Sushil Adhikari;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. Despite growing interest in WCO-based biolubricants, conventional biodiesel-derived methods fail to achieve all essential lubricant properties simultaneously, including optimal viscosity, oxidation stability, low-temperature performance, and additive miscibility. These challenges stem from the difficulty in engineering molecular structures that include linear chains, low unsaturation, high polarity, naphthenic rings, and minimal branching, all of which contribute to improved lubricity and stability. This work overcame these limitations through a multi-step catalytic process, including hydrolysis, dehydration/ketonization, Friedel–Crafts acylation/alkylation, and hydrotreatment, each of which contributed to specific improvements in lubricant properties. Hydrolysis enhanced reactivity by breaking down triglycerides into free fatty acids. Fe_3O_4-catalyzed dehydration and ketonization produced long-chain intermediates for the subsequent reaction. It was shown that acid anhydrides and ketones were the major products of this step. Friedel–Crafts (FC) acylation and alkylation, catalyzed by a Cu/ZSM5-MgO research catalyst, introduced cyclic structures that significantly decreased viscosity variations with temperature, lowered the pour point (PP), and improved miscibility with additives. Finally, hydrotreatment using a commercial Ni/SiO_2-Al_2O_3 catalyst eliminated residual unsaturation, leading to increased oxidation resistance and improved low-temperature performance. 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. The synthesized biolubricant also exhibited full miscibility with conventional base fluids and synthetic engine oils, addressing a key limitation of traditional biolubricants.

Title: Strengthening immunization access by independent community pharmacies through external collaboration

Primary Author: Hanifat Hamzat

Additional Authors: Salisa Westrick;Oluchukwu Maureen Ezeala;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Immunization access remains a critical public health challenge that is often constrained by patient-related and pharmacy-related barriers. Pharmacies are increasingly collaborating with external partners to expand vaccine uptake in a community; however, little is known about the nature and facilitators of successful partnerships. This study aims to 1) describe the different types of organizations pharmacies collaborate with to improve vaccine uptake, and 2) identify factors that make these collaborations successful. A mixed-methods approach was used in this study. Data were collected from independent community pharmacies in the United States via a national survey conducted from May – June 2024. Descriptive statistics were used to summarize the quantitative data. Ongoing qualitative analysis will inductively explore pharmacists' perspectives on what made successful partnerships through open and thematic coding to identify patterns and themes. A total of 452 participants responded to the survey. The findings indicate that employers (60.6%) and community-based organizations (44.7%) were the most common partners, while faith-based organizations (FBOs) were the least (21.5%). Overall, pharmacies had long-lasting partnerships with the partners, with fewer than 10% having < 1 year of partnership. Most pharmacies (54.0%) maintained the longest collaborations (> 5 years) with employers. Preliminary qualitative findings suggest that factors such as patients' trust, communication between the pharmacy and its respective partner, and the setting's convenience contribute to successful partnerships and immunization outreach. Findings from the study will provide helpful insights for pharmacies in forming future external partnerships or improving existing ones for immunization delivery.

Title: Sailing away synthetics to improve quality of life: marine medicine for micturition

Primary Author: Hannah DeLoit

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

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Bladder disorders, specifically detrusor underactivity and urinary incontinence, can have adverse effects on a person's quality of life. There has been an array of research done on how urinary incontinence affects different female populations, whether abnormal bladder function is due to hormone changes or the resultant pressure on the bladder due to pregnancy. In the male population, bladder disorders arise from an enlarged prostate, which creates pressure on the bladder. Urinary incontinence is a commonality among the elderly population due to a variety of factors that come with aging. Failure to coordinate voiding function by the central nervous system, bladder efferent and afferent nerve dysfunction, and detrusor muscle contractility failure cause detrusor underactivity. Studies have found that current pharmacological therapies have been unsatisfactory for the treatment of peripheral nervous system-linked bladder disorders. The adverse effects, along with a lack of selectivity and efficiency of synthetic drug mechanisms, give rise to a need to search for alternative therapies. Marine natural bioactives have recently been focused on, as they have strong pharmacodynamic qualities with no or minimal adverse effects. A literature search on PubMed was done using the keywords: "overactive bladder," "urinary retention," "urinary incontinence," "detrusor underactivity," and "marine bioactive". Several bioactives were studied and found to reduce symptoms of bladder disorders. Research showed that marine natural bioactives were adequate for enhancing the quality of life with minimal adverse drug reactions compared to synthetic medications.

Title: Couples adjustment, coping, and experiences with genetic counseling: a qualitative analysis

Primary Author: Hannah Montgomery

Additional Authors: Joshua Novak;Kate Day;Kaleigh Miller;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: When an individual receives a positive screen for a genetic condition, they may follow up with a genetic counselor. This person provides information, support, and resources for navigating the condition. However, the literature surrounding dyadic coping with chronic illness has largely overlooked the influence of genetic counseling on the coping process. Thus, the present study interviewed 16 couples who underwent genetic counseling for a positive Cystic Fibrosis carrier screen in one or both partners in order to better understand the role of genetic counseling in their overall experiences. A semi-structured interview was conducted, lasting approximately 60 minutes. The interviews explored the couple's journey from diagnosis through adjustment. The following themes emerged including (1) Impact: (a) Emotional Impact, (b) Physical Impact, (c) Family Impact, (d) Relational Impact; (2) Gaining Knowledge; (3) Adjustment: (a) Behavioral Adjustment, (b) Relational Adjustment; (4) Genetic Counseling Experience: (a) Factors of the Genetic Counselor, (b) Roles of the Genetic Counselor; (5) Factors of the Participants. These themes provide insight into the impact of receiving a positive genetic screen and highlight the role of intra- and interpersonal factors as well as genetic counseling in the adjustment process. The results of this study emphasize the important role that genetic counselors have in the process of supporting the biopsychosocial well-being of their patients. We hope to use the results of this study to help inform genetic counselors as well as patients who participate in family planning and genetic counseling in order to make that process as beneficial as possible.

Title: Gamification hearing screenings AGESv3: A validation study

Primary Author: Harper Andrews

Additional Authors: Hadley Neal;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Many individuals live without realizing that they have hearing loss due to the inaccessibility of regular hearing screenings. Detection especially in early childhood, is important to ensure that children with significant loss learn at similar rates as those without loss. This led to the development of the Auburn Graded Early Skills application (AGES app), a user-friendly application that utilizes a tablet and headphones to screen hearing quickly and efficiently. The aim is to determine the validity and reliability between the gold-standard of hearing screening and latest version of the AGES app. The study uses a "train station" activity to screen peripheral hearing of adults and children. The app was designed with adaptive learning to mimic the clinical approach to conditioning a patient during a screening across the following frequencies: 500Hz, 1000Hz, 2000Hz, and 4000Hz. Each stimuli uses novel frequency specific mixture of pure-tone (sinusoidal) and noise stimuli to stimulate each center frequency region of the cochlea. The intensity of the stimuli, measured in decibels (dB HL), begins at 50dB HL and decreases after conditioning to a screening level of 20dB HL, with a center frequency at 1000Hz. Thereafter the app randomly screens the remaining test frequencies for each ear at 20-25dB HL. Forty participants will be screened using both the gold-standard and AGES app. Participants that refer on either screening platform will have a follow-up diagnostic evaluation. Data will be compared from the gold-standard, AGES app, and comprehensive evaluations to identify patterns and calculate the sensitivity and specificity of the app. These percentages will determine whether the app is a valid and reliable option for future screenings. With the goal of releasing the app for public use, populations would be able to screen hearing with little to no need for a clinician or extra equipment, which will make screenings more accessible and efficient.

Title: Evaluating the possibility of FGE enzyme to catalyze a selenopeptide substrate

Primary Author: Hemanthie Wickramasinghe Thanthirige

Additional Authors: Katherine Rush;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: The formylglycine generating enzyme (FGE) converts a selected cysteine residue to a formylglycine residue in prokaryotes and eukaryotes. The FGE is a mononuclear copper containing enzyme and identified as an unusual oxidation catalyst due to the differences in the active site residues and active site geometry, which can differentiate FGE from other copper containing monooxygenases. The active catalytic site of FGE contains two cysteines from the FGE protein and one cysteine residue from the substrate. The objective of this study is to introduce selenocysteine in place of the substrate cysteine and extract catalytic active site information through X-ray absorption spectroscopy (XAS) techniques. The sulfur in cysteine and selenocysteine share similar chemical properties, therefore, replacing cysteine with selenocysteine is a possibility. But cysteine and selenocysteines have their own chemical differences, such as the pKa values. Since selenium is not natively present in FGE, but multiple cysteines are present, selenocysteine on substrate can be used as a probe in XAS experiments. The FGE protein from Thermomonospora curvata is produced through recombinant protein expression using Escherichia coli, purified by affinity chromatography, and followed by copper incorporation. FGE-27 is a substrate peptide which contains one cysteine at the sixth position and has been reported previously to bind to FGE. Currently, we are replicating and optimizing the synthesis of FGE-27 substrate in our laboratory. The modification of FGE-27 substrate to incorporate selenocysteine will be conducted as the next step to analyze FGE: FGE27_C6U system through XAS.

Title: Influence of age and sex on tau and beta-amyloid pathology in 3xTg mice

Primary Author: Henry Limbo

Additional Authors: Vander LeKites;Natasha Wendy Grabau;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Alzheimer's disease (AD) affects an estimated 6.7 million individuals aged 65 and older in the United States. At the molecular level, AD is marked by the accumulation of beta-amyloid (Aβ) and tau proteins, leading to neurodegeneration. While traditional research has focused on the role of insoluble Aβ and tau aggregates in AD pathology, recent studies suggest that their soluble forms, which are present earlier in AD pathology, may also play a critical role in disease progression. 3xTg mice have been used extensively to study AD, expressing both tau and Aβ. While the pathology of these mice has been described before, recent research suggests that previous characterizations of 3xTg pathology may be incomplete (e.g. lacking the quantification of soluble vs insoluble AD biomarkers, and adequately assessing differences in AD pathology between males and females). In this study, we will characterize the age- and sex-related changes in these biomarkers using the 3xTg mouse model of AD. We will quantify changes in soluble and insoluble tau and Aβ levels in 3xTg and control mice at 3, 8, and 13 months using western blotting (WB) and immunohistochemistry (IHC). WB will provide semiquantitative data on overall levels and molecular weights of tau and Aβ species in the hippocampus. IHC will examine the localization of tau and Aβ in various brain regions across ages. Antibodies targeting soluble, insoluble, and total tau and Aβ will be used in both WB and IHC. We hypothesize that aging will be associated with an increase in soluble and insoluble tau and Aβ with older brains becoming more enriched in the insoluble forms. Future aims will use information collected from this project to refine the timing of sleep interventions aimed at reducing tau and Aβ and improving cognitive outcomes.

Title: Field validation of using warm mix asphalt at reduced production temperatures for balanced mix design

Primary Author: Hilda Boateng

Additional Authors: Fan Yin;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Warm Mix Asphalt (WMA) technologies have gained popularity in the USA due to their sustainability and compaction benefits. However, their implementation, especially in balanced mix design (BMD) applications, is limited by gaps in long-term performance research. This study aims to provide field validation of asphalt mixtures with balanced rutting and cracking resistance using lower-temperature WMA through laboratory performance testing and pavement simulations of plant-produced mixtures from field projects in Missouri and Virginia. The Virginia project includes a control Hot Mix Asphalt (HMA) mixture, designed per the Virginia Department of Transportation's (VDOT) Superpave specifications, a BMD HMA mixture with 0.2% more virgin binder at mixing and compaction temperatures of 315°F and 295°F, respectively, and a BMD WMA mixture with 0.03% Evotherm S30 at reduced mixing and compaction temperatures of 275°F and 255°F, respectively. The performance testing plan included the High-Temperature Indirect Tensile Strength Test (HT-IDT) and Asphalt Pavement Analyzer (APA) for rutting evaluation, the Cantabro test for durability evaluation, and the Indirect Tensile Asphalt Cracking Test (IDEAL-CT) for cracking evaluation. The BMD HMA mixture had the highest rutting resistance, while the BMD WMA mixture had the lowest rutting resistance due to reduced asphalt aging from lower production temperatures. The BMD WMA exhibited the highest cracking resistance compared to the two HMA mixtures due to increased binder quantity and improved binder quality from using lower-temperature WMA. Despite failing VDOT's Cantabro test criteria, the BMD WMA mixture marginally outperformed the two HMA mixtures in durability. Future efforts involve characterizing the fundamental properties of these mixtures and conducting mechanistic-empirical pavement design simulations to quantify cracking performance improvements and pavement life extensions with lower-temperature WMA for BMD modifications.

Title: A nationwide serological survey for Dirofilaria immitis in companion cats in the United States of America

Primary Author: Hillier Dimino

Additional Authors: Subarna Barua;Daniel Felipe Barrantes Murillo;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Feline heartworm disease (HWD) is a complex and often misdiagnosed disease in cats, caused by the filarial nematode Dirofilaria immitis. Despite its significant impact, studies reporting the prevalence of D. immitis in apparently healthy pet cats in the USA are lacking. To investigate feline heartworm seroprevalence in apparently healthy pet cats in the USA, serum samples (n = 2165) collected from cats across 47 states and Washington District of Columbia were analyzed for D. immitis antibody and antigen with and without acid treatment of the samples. Antibodies to D. immitis antibodies were identified in 3.5% (76/2165) of cats from 26 states, with a significantly higher prevalence in cats from the westernmost US states (West region; 5.4%, 23/429) compared to those from the South (3.8%, 32/847), Midwest (2.7%, 9/338) and Northeast regions (2.2%, 12/551) ($P < 0.04$). Antigen from D. immitis was detected in 0.3% (6/2165) of cats, which was significantly lower than the antibody detection ($P < 10–4$), and no samples were positive for both antibody and antigen. This is the largest antibody-based, nationwide serosurvey of feline heartworm in an apparently healthy cat population, and the results suggest that cats in the USA have a high risk of exposure to D. immitis-infected mosquitoes. The high nationwide prevalence (3.5%) indicates that the true prevalence of cats infected with D. immitis in the USA may be significantly underestimated. Our findings emphasize the need for increased awareness and routine testing of cats for heartworm infection, especially in non-endemic areas of the USA.

Title: Effect of Oriented External Electric Fields in catalysis using immobilized Metalloporphyrins

Primary Author: Humaira Haq

Additional Authors: Ethan Hill;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: In modern inorganic catalysis, researchers have shifted focus towards new means of controlling transition metal reactivity including using oriented external electric fields (OEEFs). OEEF can serve to alter reactivity by controlling the orientation of substrate molecules, polarizing electron density of the metal center, or enhancing bond activation when oriented along the bond-forming or -breaking axis. The research presented will explore the influence of OEEFs in inorganic catalysis using transition metal complexes immobilized onto a conductive surface. Self-assembled monolayers (SAMs) using a diisocyanide linker [CN-(CH2)n-NC] have been prepared. The diisocyanide binds a Ru(TPP)CO complex (where TPP = meso-tetraphenylporphyrinato) and tether the complex at a controllable distance and orientation on gold. The SAM and presence of the ruthenium metalloporphyrin have been confirmed by electrochemical (EIS, cyclic voltammetry) and spectroscopic technique (sum frequency generation). The interfacial spectroscopic techniques, vibrational sum frequency generation (vSFG) is an interface-specific technique that has been used to characterize the modified electrodes using the C-N stretching frequency as a vibrational probe. Our aim is to examine how OEEFs alter reactivity at the Ru center with attention on two reaction types: ligand exchange and non-Faradayic catalysis. Firstly, ligand exchange studies using triphenylphosphine have been performed using cyclic voltammetry experiments to monitor shifts in the Ru(II)/(III) redox couple. Secondly, the non-Faradayic deformylation of organic aldehydes has been explored. We have observed that applying a +100 mV bias enhances the product yield and applying a negative voltage inhibits the formation of product. The preliminary results and conclusions from these studies will be discussed. This research focuses on understanding the influence of electric fields on inorganic catalysis harnessing the versatility of electric field catalysis.

Title: Short premium option strategies

Primary Author: Hunter Cyr

Additional Authors:

Department/Program: Finance

College: Harbert College of Business

Abstract: Options trading strategies that capitalize on the variance risk premium (VRP)—the compensation traders earn for insuring against market losses—have been widely studied. However, the behavior of short-premium strategies following significant price movements on major indices remains underexplored. This research investigates whether short-premium option strategies on equity indices offer a theoretical advantage after "significant" price changes, defined as discrepancies between at-the-money (ATM) straddle prices and realized underlying price changes. The study compares expected moves from ATM straddles against realized price movements using closing prices and associated option Greeks. Two portfolios are constructed: Portfolio A sells straddles daily, while Portfolio B evaluates the previous day's expected move before initiating trades. Findings suggest that Portfolio A, which involves selling straddles daily without filtering for significant price movements, yields little to no returns, reflecting the efficiency of financial markets in the long run. In contrast, Portfolio B significantly outperforms Portfolio A, with higher returns and lower Profit and Loss (PnL) volatility, by selectively trading after significant price changes. This research provides actionable insights for traders and highlights conditions under which short-premium options strategies can outperform.

Title: The pros and cons of various braces, the public's thoughts, and the exploration of braces to be developed in the future

Primary Author: Hyunwoo Lee

Additional Authors: Seungheon Kim;Chang Wook Ahn;Seungtae Kim;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Orthodontic treatment has seen a significant rise in popularity in recent years, with more people opting for braces to improve their smile and overall dental health. As advancements in technology continue to evolve, so does the variety of orthodontic devices available, allowing for more personalized and efficient treatments. This surge in interest can be attributed to a combination of factors, including the increasing awareness of oral health, the desire for aesthetic improvements, and the development of new, more comfortable, and less visible orthodontic options. Currently, millions of people around the world are undergoing orthodontic treatment. In fact, it's estimated that over 4 million Americans alone wear braces. Among these, adults are making up an increasing portion of patients, as cosmetic dentistry becomes more accessible and socially accepted. The range of available braces varies from traditional metal braces to more discrete options like clear aligners. The study aims to compare the pros and cons of various types of braces: metal braces, ceramic braces, lingual braces, clear aligners, hybrid braces, and self-ligating braces. Additionally, the research will include a survey to gather public opinions on which types of braces are most commonly used and their preferences. The goal is to analyze the results to understand trends in orthodontic treatment and the most popular options among the general public. This study also try to identify current issues in orthodontic technology, such as discomfort, long treatment times, and high costs. It will also explore innovations like 3D-printed brackets, AI-driven treatment planning, and advancements in clear aligners, with the goal of improving comfort, efficiency, and affordability in orthodontic treatments.

Title: The association between college football mass gatherings and emergency department stress: A retrospective single-site study

Primary Author: Ibrahim Alfayoumi

Additional Authors: Jieun Park;Li Zhou;Matthew Loop;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: College football weekends can impact health outcomes by stressing local emergency healthcare resources. College football games have almost 50 million attendees, which can strain local healthcare resources. However, the magnitude of these stresses on local hospital emergency departments (EDs) is poorly understood. Our objective was to evaluate hour-by-hour changes in ED presentations and waiting times in communities with a college football team. We obtained electronic medical records for all ED presentations at the University of Florida Health Shands Emergency Room/Trauma Center (Gainesville, Florida) from Jan 2011 to Jan 2023. This analysis focused on only weekends that fell within the college football regular season, and we defined "weekend" as 12 PM Friday - 12 PM Monday. We compared home game and non-home game weekends using the following outcomes measured each hour in the ED during the weekend (minutes): number of presentations, triage time, disposition time, boarding time, and ED length of stay. We employed descriptive statistics and hour-by-hour t-tests with a type 1 error rate of 0.1 to determine mean differences in our outcomes on home game weekends vs non-home game weekends. Our dataset included 1,417,060 presentations to ED. Hours with statistically significant differences in mean presentations, triage, disposition, boarding and length of stay times clustered on Saturday and Sunday afternoons/evenings. Approximately 1 more patient was admitted every hour on home game weekends on Saturday and Sunday afternoons/evenings. The maximum mean differences across all hours between home game and non-home game weekends were: triage time - 2 mins longer; disposition time - 20 mins longer; boarding time - 50 mins shorter; ED length of stay - 22 mins longer. College football mass gatherings in Gainesville, Florida, with a large academic medical center, were associated with clinically meaningful longer mean disposition and length of stay times in the ED. These findings highlight the need for targeted resource allocation and staffing adjustments during home game weekends to alleviate ED congestion and improve patient flow.

Title: Instrumental assessment of color in insect-based jerky-style pet treats with different ratios of crickets (Gryllodes sigillatus) and chicken liver

Primary Author: Ileana Maria Berganza Portillo

Additional Authors: Jessica Starkey;Xenia Murillo Contreras;Hilary Gisselle Carrera Arcia;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The pet food industry is enhancing product quality, with a growing interest in using insects as ingredients, as well as poultry co-products as affordable protein sources. The objective of this study was to evaluate instrumental color differences among insect-based, jerky-style treats containing different ratios of crickets (Gryllodes sigillatus; C) ground to meal and ground raw chicken liver (CL) over time. Three inclusion ratios: 50% C:50% CL, 70% C:30% CL, and 90% C:10% CL. Each mixture contained 1% sodium alginate and 0.85% encapsulated calcium lactate. Raw mixtures were extruded into jerky strips, refrigerated overnight, and dehydrated for 3.5 hours. Instrumental color was measured on days 0, 1, 3, 5, and 7 post-production using a Hunter Lab Mini Scan spectrophotometer using the CIE color space where lightness (L^*), redness (a^*), and yellowness (b^*) are determined on 18 samples from 3 independent batches per treatment. Delta-E (ΔE) values were calculated to determine visual perception of color differences by the human eye. Data were analyzed as a 2-way ANOVA with treatment and days post-production as the fixed effects with the GLIMMIX procedure of SAS ver. 9.4 with means separated at $P \leq 0.05$. Results showed that the 50% C:50% CL treats were lightest, least red, and most yellow 7 days post-production ($P \leq 0.05$). Over time, all treatments became lighter, less red, and more yellow. The color changes between day 0 to 1 were minimal ($\Delta E \leq 1.0$), but from day 0 to 7, ΔE values ranged from 2 to 10, making them noticeable at a glance by the human eye. The 50% C:50% CL treatment had the largest ΔE value (3.07), while the 70% and 90% C treatments had values of 2.39 and 2.48. This study demonstrates that combining crickets with CL and a structure-forming agent creates an insect-based jerky-style treat, and the inclusion of crickets alters the color such that a consumer can detect these color differences at a glance after 7 days of cold storage.

Title: Evaluation of the big fish problem in the United States catfish industry

Primary Author: Ilerioluwase Oyedele

Additional Authors: Luke Roy;Taryn Garlock;Anita Kelly;Jesse James;Larry Lawson;Leticia Fantini Hoag;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: The catfish industry is the largest aquaculture industry in the U.S. by production volume, and Alabama ranks second in catfish production. Premium market size of catfish for the catfish industry is between 1.25 – 4 pounds (0.45 – 1.81 kg). When catfish exceed the premium size, farmers receive a much-reduced price for their fish. Big catfish are more difficult to handle in the processing plants because they do not fit existing mechanized equipment, and they can be a challenge to sell to existing market outlets. Fish that exceed premium market size have been termed "big fish" by the catfish industry. Big fish represent a significant challenge for producers and fish processors, especially when it comes to hybrid catfish, a cross between Ictalurus punctatus (Channel Catfish) and Ictalurus furcatus (Blue Catfish). Hybrid catfish attain a much larger size in a much shorter time frame than channel catfish, which has historically been the choice of commercial producers until the emergence of the hybrid catfish. Farmers receive a reduced price for fish that grow beyond market size, which results in reduced prices and considerable economic losses. Additionally, these larger fish can become aggressive, preying on smaller fingerlings and causing further economic losses. This project aims to assess the potential of cannibalism of big catfish on catfish fingerlings in both hybrid and channel catfish. Large catfish (6 – 30 lbs) will be collected in west Alabama and stocked in ponds at the E.W. Shell Fisheries Center. Catfish fingerlings will be stocked in the same pond to determine the extent to which cannibalism occurs in pond environments. Pond experiments will be carried out in the winter and summer months to evaluate seasonal differences in cannibalistic behavior by large catfish. Looking ahead, we plan to develop best management practices (BMPs) to reduce the occurrence of oversized fish, improve seining techniques for better harvests, and establish regular monitoring protocols to keep track of fish growth and health. We also aim to educate catfish farmers about these practices to enhance their understanding and adoption. Ultimately, by tackling the big fish problem, this research strives to provide practical solutions that will benefit catfish farmers and boost the efficiency and profitability of the aquaculture industry.

Title: Predicting the shelf life of ground beef based on the initial microbial community profile

Primary Author: Isabella Gafanha

Additional Authors:

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Food waste is a growing global issue that impacts consumers, producers, and environmental sustainability. Food insecurity is also a critical issue, with an estimated 900 million people affected by severe food insecurity, globally, in 2022. The production of high-quality food products, including beef products, in the US may alleviate this; however, many of those meat products that are produced tend to be discarded before they can be consumed. In 2024, an estimated one-fifth of the food that was produced globally was wasted. One of the primary reasons for this elevated food waste at the consumer and retail level is the use of overly conservative sell-by and use-by dates on packages. These dates are an estimate of when the product will be too spoiled to sell or consume, though the products are generally still good days after. Consumers tend to believe that these dates are definitive markers of food safety of the product and will discard it according to those conservative dates. Therefore, it is important that these dates accurately express the product's shelf life, so it is not discarded prematurely. Meat spoilage is driven by numerous factors, but primarily by microbial activity. The bacteria that populate the surface of the meat break down the tissue and produce the chemical compounds that cause off-odors and flavors of spoiled meat, as well as discoloration, slime, and gas production. The goal of this research project is to monitor the changes in microbial community structures over a 14-day shelf life and apply machine learning to generate a practical model of spoilage for predicting shelf life. Throughout the 14-day sampling, data was collected through colorimeter testing, lipid oxidation testing, microbial aerobic plate counts, and meat component analysis. The overall microbial communities were assessed using amplicon sequencing methods and DNA extraction was performed using the Illumina miSeq platform. A statistical assessment of the microbial taxonomies was used to see how they change over time. Following this, a Random Forest regression machine learning algorithm will be constructed to predict the day the product is considered microbiologically and sensory spoiled. The quality analysis results show that the product was microbiologically spoiled at day 6 of the experimental period, with spoilage being defined as a microbial aerobic plate count (APC) of 7 logCFU/g. Further evidence of spoilage included the HunterLab colorimeter data that demonstrated decreasing L* values as spoilage progressed, meaning the lightness of the cherry red color was becoming darker. Additionally, the redness values decreased throughout spoilage as oxidation occurred. The results from lipid oxidation also demonstrate spoilage as the values of mg/kg of malonaldehyde increase. As we continue our analysis, the microbial communities involved became less diverse as certain organisms tend to outcompete the others in the environment. Prior to spoilage, the communities included families such as Rhodobacteraceae, and as spoilage progressed, families Pseudomonadaceae and Carnobacteriaceae increased. This pattern will help with predicting the rate of product spoilage.

Title: Cytotoxic and immunogenic properties of an armed oncolytic adenovirus in osteosarcoma

Primary Author: Isabella Shimko-Lofano

Additional Authors: Payal Agarwal;Terri Higgins;Sumbul Khan;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Cancer immunotherapy enhances the immune response to target and recognize tumors in the tumor microenvironment (TME). However, there is limited research on the effects of immunotherapies in solid tumor cancers, such as osteosarcoma. Conditionally replicative oncolytic adenoviruses are specifically replicative in tumor cells and lyse only tumor cells without harming non-cancerous tissues. Oncolytic adenoviruses can remodel the tumor microenvironment and turn the "cold" tumor (immunity-wise) into a "hot" one which means attracting immune cells to the TME. Another aspect to this immunotherapy is using immune checkpoint inhibitors such as PD-1 and PD-L1 which prohibit T cells from attacking cancer cells. By inhibiting this interaction between T cells and tumor cells it can allow T cells to recognize the tumor and kill it. We have modified canine adenovirus type two (CAV2) to generate CAV2-AU-M3 to replicate in tumor cells conditionally and to produce and secrete canine anti-PD-1 antibodies. We analyzed the cytotoxic effects of CAV2-AU-M3 in canine osteosarcoma cell lines (D17, D22, CF11, and MCKOS) in 2D and 3D models. Cell viability was determined using images and luciferase assays. Additionally, we plan to test the immunogenic properties of CAV2-AU-M3 by measuring INF-γ and TNF-α cytokine levels cytokines released by tumor cells after CAV2-AU-M3 infections using ELISA tests. CAV2-AU-M3 is effective at lysing canine osteosarcoma cells, and we expect infected tumor cells to release cytokines into the TME. This research will provide insights into immunotherapy effectiveness for solid tumor cancers, and will be used to develop new treatment potential for dog and human osteosarcoma patients.

Title: Educating for Change: Evaluating the Effectiveness of Abstinence and Comprehensive Sex Education on Adolescents' Sexual Health.

Primary Author: Italy Slaughter

Additional Authors: Adrienne Marks;Sandra Anti Eyiah;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: The effectiveness of sexual education approaches remains a contentious issue, with varying opinions on the best methods to educate young people. Adolescents' decisions to engage in sexual activity are influenced by a multitude of factors, including sex education, peer dynamics, and socio-cultural contexts. The implementation of sex education plays a crucial role in shaping these decisions by equipping young people with essential knowledge and skills. Research reveals that the average age of sexual initiation among adolescents ranges from approximately 14 to 15 years, raising questions about the most effective approach to reducing risky sexual behaviors. Sexual behaviors that pose the most risk includes and are not limited to unprotected sex, sex during intoxication, and having multiple sexual partners which can lead to unplanned pregnancy or contracting and spreading sexually transmitted diseases among adolescents. Previous research suggests that abstinence-only education is effective for a short-term period; however, comprehensive education has been suggested to be more effective in the long run. Unlike abstinence-only programs, comprehensive sex education not only promotes abstinence but also provides knowledge on safer sexual practices. For this reason, this study seeks to evaluate the effectiveness of both abstinence and comprehensive sex education on adolescents' knowledge of sexual health and intentions to reduce their sexual risk behaviors using data from statewide sexual education programs. Also, we seek to compare which sexual education approach is most effective in increasing adolescents' knowledge about sexual health as well as their intention to reduce sexual risk behaviors.

Title: A Fatigue Failure-Based Framework for Continuous Risk Assessment in the Low Back Region Using Inertial Motion Capture - A Case Study

Primary Author: Ivan Enrique Nail Ulloa

Additional Authors: Sean Gallagher;Mark Schall;Richard Sesek;Bob Sesek;Nathan Pool;Michael Zabala;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Workers in manufacturing settings experience highly variable musculoskeletal loading, which current risk assessment methods often fail to fully capture. This study evaluated a Fatigue Failure-Based framework for estimating continuous lumbar loading from variable occupational loads. Worker movements and postures were recorded using an Inertial Motion Capture system, and L5/S1 joint loading history was estimated through inverse dynamics. Stress cycles were analyzed using Rainflow analysis, adjusted with Goodman's method, and summed using Palmgren-Miner rule to estimate cumulative damage. The framework was tested in live industrial settings with eight automotive workers across 108 trials. Logistic regression models demonstrated significant correlations between cumulative damage estimates and self-reported low-back pain (OR = 2.16, 95% CI: 1.30, 3.57). This framework provides a novel method for analyzing highly variable loading to estimate cumulative exposure in ergonomics, offering a starting point for future research and potential applications in assessing low back injury risks in similar occupational settings.

Title: Experimentally evaluating the properties of a de novo-designed ideal therapeutic protein scaffold

Primary Author: Jacinta Amoakoa-Djan

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Therapeutic proteins are genetically engineered biomolecules used for the treatment of diseases. Antibodies are the most widely utilized proteins in therapeutic development. They serve as the body's primary defense against diseases, protecting it from foreign invaders called antigens. While antibodies are widely applicable, they pose significant challenges that cannot be overlooked. Their large size restricts effective penetration into tumors, and the presence of multiple drug conjugation sites raises the risk of overdose. These factors notably constrain their therapeutic applications. The PROTEINPANT(z) Lab has previously designed therapeutic protein scaffold de novo using computational tools as alternatives to antibodies. This protein scaffold is a small single-domain protein, engineered to be highly soluble and thermostable, with only a single site for drug conjugation. The design addresses the limitations of antibodies, making these scaffolds 'ideal' for therapeutic applications. This project focuses on experimentally expressing and evaluating the ideal protein scaffold and testing its properties: solubility, thermostability, and immunogenicity. Eventually, the goal is to test the binding properties of the ideal protein scaffold to a specific antigen of interest and build libraries of the ideal therapeutic protein scaffold with high binding affinity and specificity. The project encompasses various stages. First, the computationally designed protein sequences have been reverse-transcribed and codon-optimized using GenSmart 2.0 for expression in E. coli. The optimized DNA sequences are cloned into pET-21a (+) plasmid vectors, which are transformed into (BL21(DE3) competent E. coli cells and induced for the expression of the ideal therapeutic protein of interest. After the protein is isolated and purified, solubility and thermostability assays will be carried out to compare and validate results from the computational analysis.

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;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Vibrio species comprise a diverse heterotrophic group of marine bacteria and are the causative agents of many different pathologies in marine invertebrates. Specifically, the pathogenic species V. diazotrophicus and V, splendidus elicit strong immune responses in adult and larval purple sea urchins (Strongylocentrotus purpuratus). Sea urchins provide a unique model system in which to study immune responses. As invertebrate deuterostomes, sea urchins share important genetic similarities with vertebrates but are morphologically simple and transparent. The larval immune response relies on complex networks of pattern recognition receptors (e.g., Toll-like receptors [TLRs] and Nod-like receptors [NLRs]) that detect microbes and activate immune responses. In larvae, this response is characterized by immune cell migration and rapid production of the cytokine IL-17. Exposure to live V. splendidus results in larval death, whereas live V. diazotrophicus elicits a robust, non-lethal inflammatory response. However, exposure to heat- or chemically killed bacteria significantly reduces the larval immune response, although many of the bacterial antigens remain. We thus hypothesize that the pathogenicity of both these species is, in part, due to virulence factors in their native conformation that are lost due to the heat and/or chemical killing methods. To test this hypothesis, we developed a set of novel genetic tools to create conditionally auxotrophic strains of both V. splendidus and V. diazotrophicus. These strains lack the essential cell wall biosynthetic gene dapA, responsible for eventual synthesis of 2,6-diaminopimelic acid. When bacteria are added to seawater that lacks this supplement, cell viability and membrane integrity are lost but protein structures remain intact. This work represents the first investigation of specific conformational contributions that bacterial antigens have on pathogenicity in echinoderms.

Title: Peak rate of force development during 5x sit-to-stand as an indicator of cognitive function in younger adults: A pilot study

Primary Author: Jacob Jerkins

Additional Authors: Jaimie Roper;Brandon Peoples;Kenneth Harrison;Keven Gerardo Santamaria-Guzman;Aubrey Harrell;Bria Smith;Clay Williams;Grant Renfrow;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Identifying markers of central nervous system (CNS) dysfunction is vital as the global population ages. Peak rate of force development (pRFD), which indicates neuromuscular fatigue, offers insights into CNS function and is associated with cognitive impairment. This study aims to 1) investigate the relationship between pRFD during the 5x Sit-to-Stand (5xSTS) and various cognitive domains, 2) examine the difference in pRFD between four 5xSTS conditions -normal with and without a heel raise, staggered with their dominant leg forward, and staggered with their non-dominant leg forward. Six adults (3 males) aged 18 to 27 participated in this study. Participants completed two trials of four conditions of the 5xSTS using marker-based motion capture. They were instructed to perform the 5xSTS as quickly as possible. pRFD was measured during the 5xSTS test using in-ground force plates, calculated by assessing the change in force relative to the change in time. Participants performed the Trail-Making Test (TMT) A and B, the Digit Span Test (DST) forward and backward, and the Mini-Mental State Examination (MMSE), assessing working memory, attention, executive function, cognitive control, and cognitive flexibility. Pearson's correlation analysis was used to assess the relationship between outcomes, and a one-way ANOVA was used to assess the differences in pRFD. Our analysis revealed that pRFD during the 5xSTS is moderately associated with improved working memory, attention, executive function, cognitive control, and cognitive flexibility ($r = .44$ to $.59$, $p < .01$) in younger adults. Our ANOVA revealed no significant difference in pRFD between 5xSTS conditions ($p > 0.05$). In our sample, pRFD generated during the 5xSTS correlates with various cognitive domains. pRFD generated during the 5xSTS may be a valuable indicator for identifying individuals at risk of cognitive decline. Future research should aim to replicate these findings in larger samples and among older adult populations.

Title: Stiffness and Deflection of Custom-Fit, 3D-Printed Ankle-Foot Orthoses During Walking and the Influence of Anthropometric Variability

Primary Author: Jacquelyn Brokamp

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

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Additive manufacturing enables the rapid production and customization of ankle-foot orthoses (AFOs), offering substantial advantages over traditional fabrication methods. Understanding the mechanical properties of these devices, particularly stiffness and deflection during ambulation, is essential for their effective deployment as it may inform future benchtop performance tests, such as fatigue life analysis. However, previous studies seemingly disregard the combined effects of the passive and active ankle joint contributions to stiffness during ambulation, limiting the predictive accuracy of the mechanical performance tests. Accordingly, this study investigates how the AFO-ankle complex quasi-stiffness (the combined stiffness of the AFO and the ankle joint) and participant-specific anthropometric measures (height and body mass) influence AFO deflection throughout the gait cycle. Nine healthy, unimpaired participants were fitted unilaterally with custom-fit AFOs fabricated using XO-Armor® 3D-scanning and 3D-printing technology. Gait analyses were conducted under AFO and no-AFO conditions, focusing on three subphases of stance: controlled plantarflexion (CPF), controlled dorsiflexion (CDF), and powered plantarflexion (PPF). The results revealed significant positive correlations between anthropometric measures and both AFO-ankle complex quasi-stiffness throughout stance phase and peak AFO deflection in dorsiflexion ( ). Additionally, AFO-ankle complex quasi-stiffness during CDF () exhibited an inverse relationship with . No significant relationships were identified between maximum deflection in plantarflexion () and either anthropometric measures or AFO-ankle complex quasi-stiffness during PPF (). The findings of this study suggest that height, weight, and should be considered when developing standardized protocols for custom-fit AFOs to enhance the predictive accuracy of benchtop testing, particularly when estimating .

Title: Reducing rebuilding costs through efficient home footprints in Palisades, California

Primary Author: Jaden Bence

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Wildfire occurrences have increased in the state of California due to climate change, prolonged droughts, and higher temperatures. This research focuses on the design of fire-safe homes in Palisades, California, emphasizing reducing rebuilding costs for families affected by recent disasters. Given the high frequency and severity of catastrophic fires, such as the Camp Fire in 2018, which killed 85 people and burned nearly 19,000 homes, and the recent Palisades Fire which killed at least 29 people and destroyed 6,822 buildings, many of them homes, there is an urgent need for residential designs that prioritize fire safety and efficiency while limiting the cost of rehabilitation. The average cost of rebuilding a home destroyed by the Camp Fire was estimated at $300 per square foot, significantly higher than the national average of $150 per square foot, making recovery financially difficult for many homeowners. Since 2018, many California homes in the Palisades and other regions have lost fire insurance due to the high risk, making the potential cost of rebuilding an increased burden on many homeowners. In response, this research proposes a design strategy that increases the fire resistance of structures while reducing the average home footprint by 40%, offering a more cost-effective alternative while maintaining crucial fire safety standards. The findings indicate that smaller, more efficient dwellings can be rebuilt safely and affordably using fire-resistant materials, defensible space, and other fire safety measures. This research will also explore the balance between reducing square footage and maintaining livability and comfort for residents. Furthermore, this timely research deploys a thorough framework for constructing homes that are not only resistant to wildfires but also more financially practical for California households, promoting sustainable development in a state prone to fire-related tragedy.

Title: Understanding resin secretion in loblolly pine's defense against brown spot needle blight

Primary Author: Jaden King

Additional Authors:

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Loblolly pine (Pinus taeda L.) is vital for the economic stability of the southeastern U.S. and is the most common tree species in Alabama. However, it faces threats from the pathogen Lecanosticta acicola, which causes brown spot needle blight (BSNB). This study aimed to assess resin secretion, an important defense mechanism, in relation to varying disease levels in loblolly pine. We hypothesized trees with more disease would secrete more resin than trees with less disease to help overcome and prevent the disease from invading. Thirteen plots in Alabama were established and resin was collected by tapping the trees and measuring the amount of resin secreted in 24 hours. Additionally, trees were rated for disease severity on a scale from 1 (low infection) to 3 (high infection). Analysis was conducted in R using a general linear mixed model, with plot treated as a random factor to account for variations in stand composition and environmental conditions. Trees with a medium disease rating secreted 25% more resin than those with a low rating, while highly diseased trees secreted 20% more resin than those with a low rating. While our findings were not statistically significant, our findings may be biologically relevant since trees with more disease tend to produce more resin. This observation offers insight into how trees respond to diseases caused by BSNB by increasing resin production. The elevated resin levels in more diseased trees may act as a defense mechanism, helping to protect them from secondary pathogens, such as the southern pine beetle, which targets already stressed trees. In addition, understanding the biology behind how the tree responds to disease will allow for improved management practices for landowners dealing with BSNB.

Title: Skeeter World: Modeling the Emergence and Spread of Cytoplasmic Incompatibility

Primary Author: James Browning

Additional Authors: Daniel Tauritz;John Beckmann;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: The bacteria Wolbachia is the most common reproductive parasite on Earth, a position it claimed, in part, through a simple toxin-antidote system. Through the production of a lethal toxin in an infected male's testes and a matching antidote in an infected female's eggs, infection becomes necessary for successful reproduction. Described is Skeeter World, an online platform for modeling the emergence and spread of infectious agents like Wolbachia in mosquito populations, which is helping to elucidate how toxin-antidote systems evolved in the first place. Popular, well-supported web frameworks, such as Node.js and Express, are employed to make this simulation work. This project builds on the work of Beckmann et al. from 2023, which suggested that there are multiple avenues by which this mechanism could have originally evolved in nature, and preliminary data generated with Skeeter World supports that hypothesis.

Title: The use of AR and BIM-based framework to support quality control inspections at construction job sites

Primary Author: James Toyin

Additional Authors:

Department/Program: Building Science

College: College of Architecture, Design and Construction

Abstract: Evidence shows that rework in construction projects accounts for up to 5% of total contract value, leading to substantial financial losses. With the U.S. construction industry valued at $2.1 trillion annually, this equates to potential losses of $105 billion per year due to deficiencies in quality control. These inefficiencies increase costs, cause delays, and waste resources. To address this challenge, the industry is increasingly adopting digital technologies such as Building Information Modeling (BIM), Augmented Reality (AR), drones, and robotics to enhance efficiency and reduce errors. Among these innovations, AR and BIM integration offers a transformative solution for quality control inspections by improving visualization, collaboration, and real-time decision-making on construction sites. BIM provides 3D models detailing a building's physical and functional characteristics, while AR overlays digital content onto real-world environments, enabling inspectors to compare design intent with actual progress in real-time. This capability enhances early issue detection, mitigates risks, and improves inspection accuracy, in the end reduces costly rework. This research proposes a conceptual framework integrating AR and BIM to optimize quality control inspections in U.S. construction. The framework requires AR glasses, BIM models, tablets, and trained inspectors to facilitate seamless interaction between digital models and physical structures. By enabling real-time defect detection, automated documentation, and data-driven decision-making, this integration enhances inspection accuracy and efficiency, while reducing reliance on manual quality control methods. To validate the framework, case studies on active U.S. construction sites will be conducted to assess its impact on inspection efficiency, error detection, and overall project quality. The findings will provide valuable insights for construction firms, policymakers, and technology developers, supporting digital transformation and improved quality assurance in the industry.

Title: Families' Experiences with Books and their Infants in the Context of Pediatric Primary Care

Primary Author: Jamie Gensbauer

Additional Authors: Cynthia Frosch;Olivia Martin-Pinon;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: The recent ZERO TO THREE report (2023) calls attention to tremendous between-state variability in policies and practices to support strong families and healthy early development, with southern states faring poorly compared to other states on multiple indicators of family and child well-being including maternal mental health and parents' engagement in shared reading with their infants and toddlers, a key indicator of positive early learning experiences. Klass (2024) calls for pediatric primary care providers to encourage shared book reading during infants' well-child visits. Yet, the quality of the relationship that parents share with their child's pediatrician may be important for understanding care outcomes (Nobile & Droter, 2003). This study explored families' experiences with books and their infants in the context of Reach Out and Read (ROR), a national physician-to-family program focused on promoting shared reading in families, particularly within lower-resourced communities. Parents of infants (N = 173; 86% mothers) in a southern U.S. state were recruited diverse pediatric clinics implementing ROR. Participants completed an online survey and reported on their anxiety and depression symptoms (PHQ-4), shared book reading frequency, parent-provider relationship quality, and perceptions of the ROR program. Insurance (private; public) was used as a proxy for SES. Parents who reported higher quality relationships with their infant's pediatrician and fewer depression symptoms liked the book they received from their infant's pediatrician more. The overall model explained 10% of the variance in shared book reading frequency; insurance (B = .94; p < .01) and anxiety symptoms (B = -.35; p = .01) were significant predictors. Parents with private insurance and fewer anxiety symptoms reported greater shared book reading frequency with their infants. Results suggest the value of considering the parent-provider relationship, parental mental health, and SES when understanding families' experiences with books and their infants in the context of pediatric primary care clinics implementing ROR.

Title: Synergistic use of spaceborne GEDI and ICESat-2 lidar data for mapping forest canopy height

Primary Author: Janaki Sandamali Kuda Udage

Additional Authors: Lana Narine;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Spatially continuous estimates of forest canopy height (CH) are crucial for quantifying forest carbon storage, mitigating climate change, and informing sustainable forest management decisions. The Global Ecosystem Dynamics Investigation (GEDI) and the Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) light detection and ranging (lidar) missions provide discrete, along-track measurements of vegetation structure. However, the synergistic utilization of data from these space-based missions for generating mapped CH remains underexplored in temperate mixed forests, like those of the southern United States. This study aims to develop a fusion approach for mapping CH using GEDI and ICESat-2 data. The specific objectives are to (1) evaluate the performance of Random Forest (RF), Extreme Gradient Boosting (XGBoost), and Convolutional Neural Networks (CNN) to identify the most accurate approach for estimating CH using combined GEDI and ICESat-2 samples with other Earth observation datasets, and (2) create a regional-scale 30 m forest CH map by applying the most accurate modeling approach within a high-performance computing (HPC) environment. To achieve these objectives, we combined GEDI footprints, ICESat-2 ATL08 land and vegetation segments, and multi-source predictors, including from Landsat 9, Sentinel-1, and Sentinel-2 satellites, climate variables, and ancillary geospatial datasets (e.g., topography and vegetation cover) within an HPC environment. Preliminary results indicate the highest accuracy with XGBoost in a synergistic approach compared to RF and CNN, yielding a coefficient of determination (R^2) of 0.60 and a root mean square error (RMSE) of 4.36 m. The next step will involve further assessment of CH accuracy using information derived from reference airborne lidar data. These findings underscore the potential of combining GEDI and ICESat-2 data in HPC to improve CH mapping, advance terrestrial carbon quantification, and enhance forest ecosystem assessments.

Title: Symptom Severity, Management, and Depressive Symptoms in U.S. Adults with Irritable Bowel Syndrome

Primary Author: Jane Greene

Additional Authors: Drew Fruge;Sarah Lennon;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Irritable Bowel Syndrome (IBS) is a condition suffered by tens of millions of adults in the United States (US), that is underdiagnosed, poorly managed, and greatly impacts quality of life (QOL) in patients. We conducted a nation-wide survey in US adults with IBS (using Rome IV criteria) between the ages of 18 and 50 years to determine the incidence and efficacy of symptom management approaches and their association with depression severity, measured by the nine-item Patient Health Questionnaire (PHQ-9). The survey was distributed by Qualtrics Panels from 24 July to 09 August, 2023. Between sex differences were obtained with chi-squared and independent samples t-tests. Backward stepwise linear regression determined the predictive value of independent variables on PHQ-9 scores. Of 2,063 attempted responses, 1,654 were excluded for having comorbid gastrointestinal diagnoses, non-current symptoms, or failed attention check questions. Of 400 valid responses analyzed, 63% were medically diagnosed with IBS, 86% were female, 93% were non-Hispanic, with average age 34±9 years and body mass index (BMI) 29.2±7.9 kg/m2 . Average PHQ-9 score was 11.6±6.1 (range 0-27). The most frequently avoided dietary items (>15% of respondents) were dairy, artificial sweeteners, high fructose corn syrup, gluten, and processed meats. Among pharmaceutical and integrative therapeutic approaches, >25% of respondents reported over-the-counter drugs, probiotic supplements, therapy to reduce stress, and meditation. Severity of regular symptoms (β=.281, p<.001) but not flare-ups, age (β=-.191, p<.001), but not years experiencing symptoms, and BMI (β=.117, p=.015) were predictive of depression severity. Among this sample of US adults with IBS, greater symptom management was observed with avoidance of several foods, as well as therapy and meditation to reduce stress. Healthcare providers should help patients determine best approaches for IBS symptom management to reduce depressive symptoms.

Title: Carbon storage status of open ecosystems before restoration in Central Tennessee

Primary Author: Jayro Chevez Sahona

Additional Authors: Tamara Milton;Heather Alexander;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Open ecosystems (i.e. prairies, savannas, open woodlands) are important ecosystems that once dominated much of the eastern U.S. landscape. Unfortunately, over 90% of these systems have disappeared since European settlement due to various factors such as fire suppression, overgrazing, and land conversion. This situation has also led to the loss of plant diversity, wildlife, and pollinators, prompting restoration initiatives on former croplands, pastures, and closed-canopy forests. Ongoing efforts in Tennessee aim to restore closed-canopy forests to (oak) savannas, however, questions remain about the potential of these systems to provide other ecosystem services like carbon (C) sequestration and storage, especially after facing new disturbances from restoration practices. Therefore, understanding current C storage levels is crucial. This study addressed this gap by examining the present distribution of C storage pools in remnant oak savannas prior to restoration, and how C storage varies in the evaluated pools in oak savannas compared to those in different open-to-closed ecosystems. Last summer, plots were established in oak savannas locations in west Clarksville, TN, to measure C stored in pools (understory vegetation, leaf litter, live and dead trees, leaf litter, organic soils) with the help of the combination of harvesting protocols and allometric questions. Findings pointed out that in oak savannas remnants (DOSRe), 74.32% (49.99 tC/ha) of the C stored was found in trees and snags present in the plots, followed by 11.66% (7.84 tC/ha) from understory vegetation pool. For leaf litter, organic soil and woody debris pool, it was found that they represented 8.14% (5.48 tC/ha), 4.90% (3.30 tC/ha), and 0.98% (0.66 tC/ha) of the total C stored in these systems, respectively. When comparing DOSRe to other systems in different open-to-closed gradients, results indicated that prairie remnants stored C in only three assessed pools: understory vegetation (74.64% - 15.86 tC/ha; organic soil: 14.83% - 3.15 tC/ha; leaf litter: 10.53% - 2.24 tC/ha); meanwhile, closed-canopy forest stored the highest C content in live and dead trees (102.57 tC/ha) compared to its other pools (leaf litter: 6.78 tC/ha; organic soils: 6.38 tC/ha; woody debris: 6.29 tC/ha, understory vegetation: 0.77 tC/ha). Differences between systems are significant ($p < 0.05$). This research enhances the understanding of the carbon dynamics in open ecosystems remarking on the necessity of evaluating C in-ground and above-ground levels so that restoration management strategies can be performed effectively.

Title: Characterization of phagocytosis within the hemolymph of the American cockroach

Primary Author: Jenna Smith

Additional Authors: Madalyn Wade;Renee Ratterree;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: A universal characteristic of organisms is the ability to defend against and eliminate foreign invaders, maintained by their immune system. Research has shown that an effective microbiome provides immune enhancements in both simple and complex organisms. Cockroaches, such as Periplaneta americana, have a diverse microbiome compared to other insects. Due to only possessing an innate immune system, an important factor of defense is phagocytosis, or "cell-eating"– the ability of a cell to engulf and digest particles, such as cellular debris or antigens, to maintain homeostasis. Though thoroughly researched in complex organisms such as humans and mice, the innate immune system of cockroaches, specifically P. americana, is understudied. Using flow cytometry and pH sensitive fluorophores, this research examines the different cell subpopulations within P. americana hemolymph to determine phagocytic capabilities. Results show the bifurcation of the cell population into phagocytosis-positive and phagocytosis-negative based on their fluorescent properties. An additional distinction of subpopulations includes differences in both cell size and complexity, which may play a role in the phagocytic capabilities of the cell. This research lays the foundation for phagocytosis under normal physiological conditions in the American cockroach. Therefore, further research is needed to explore potential factors that can impact this process, such as differences between an axenic (germ-free) versus a normal microbiome condition.

Title: Wnt inhibitory factor-1 fine-tunes early Wnt-mediated endomesoderm and neuroectoderm patterning in sea urchin embryos

Primary Author: Jennifer Fenner

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Wnt signaling drives germ layer (endoderm, mesoderm, and ectoderm) specification and patterning along the anterior-posterior (AP) axis during early embryonic development of across metazoans from cnidarians to humans. Despite the importance of Wnt signaling in many developmental processes we still have a limited understanding of how diverse Wnt signals are modulated during embryogenesis in any model system. 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. We have previously shown that several extracellular Wnt modulators (e.g., DKKs and sFRPs) regulate the AP Wnt signaling network during positioning of each early germ layer gene regulatory network (GRNs) along the AP axis. Here, we examined the role of a poorly characterized extracellular Wnt signaling modulator, Wnt inhibitory factor-1 (Wif1), during early sea urchin embryogenesis. We show that wif1 expression in the posterior endomesoderm is regulated by canonical and non-canonical Wnt signaling but that BMP2/4/7 signaling activates wif1 expression in the dorsal ectoderm. Perturbations of Wif1 result in downregulation of key genes in the endomesoderm GRN leading to gastrulation defects. Our functional assays also indicate that during late blastula stages Wif1 in the dorsal ectoderm works synergistically with Wnt7 to position specific anterior neuroectoderm (ANE) GRN components around the anterior pole. Together, our findings show that Wif1 is a previously uncharacterized member of the posterior Wnt signaling landscape that establishes critical regulatory subcircuits in the sea urchin endomesoderm GRN. And that activation of Wif1 by dorsal BMP2/4/7 signaling and Wif1's subsequent refinement of patterning within the ANE territory establishes an important link between anterior-posterior and dorsal-ventral axial patterning processes.

Title: Sociocultural Pressures, Interpersonal Functioning, and Eating Pathology in Gender Expansive Adults

Primary Author: Jennifer Finkelstein

Additional Authors: Tiffany Brown;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Transgender and gender expansive (TGE) folks are at heightened risk for eating disorders (ED), in part due to discrimination and pressures from family, peers, and within the LGBTQ community to achieve the appearance ideal. Sociocultural pressures are likely to impact interpersonal emotional functioning (interpersonal needs, interpersonal emotion regulation), which are also associated with EDs. No studies have explored the impact of these pressures in TGE samples, a population with higher rates of victimization, maladaptive coping, and ED risk due to minority stress. The present study aimed to identify the effects of family, peer and community-specific pressures on ED pathology and interpersonal emotional functioning in TGE individuals. TGE participants completed the Sociocultural Attitudes Toward Appearance Questionnaire-4 (SATAQ; Family, Peer, and added LGBTQ Pressures), the Difficulties in Interpersonal Regulation of Emotions (DIRE; Venting, Reassurance Seeking) Scale, the Interpersonal Needs Questionnaire (INQ; Burdensomeness, Belongingness), and the Eating Pathology Symptoms Inventory (EPSI) Restricting, Binge Eating, and Purging subscales. Regression models examined associations between SATAQ-4 subscales and EPSI, DIRE, and INQ scores. Greater Family pressure was associated with Restriction ($p = .046$), Binge Eating ($p < .001$), and lower Belongingness ($p = .009$). Peer pressure was associated with Venting ($p = .045$), Binge Eating ($p = .022$), and Purging ($p < .001$). LGBT pressure was associated with Binge Eating ($p = .033$), and Venting ($p = .027$). Results reinforce the impact of appearance-based pressures on ED symptoms and interpersonal emotional functioning in TGE folks. Family pressures were more consistently linked with internalizing ED/interpersonal symptoms, while peer and LGBTQ pressures were more associated with externalizing ED/interpersonal factors. Future work could explore associations longitudinally to inform intervention efforts for TGE folks.

Title: Pan-RAS inhibitor therapy as a treatment for multiple myeloma

Primary Author: Jeremiah Pfitzer

Additional Authors: Amit Mitra;Gary Piazza;Yulia Maxuitenko;Xi Chen;Adam Keeton;Sarah Batten;Ray Waliagha;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Mutations in RAS genes are the most common somatic variations in multiple myeloma (MM). >64% of patients with refractory/relapsed MM (rrMM) carry RAS/RAF mutations. We discovered & developed the highly potent and selective pan-RAS inhibitor, ADT-007, capable of suppressing MAPK/AKT signaling by blocking GTP activation of RAS. Here, we show that ADT-007 is effective against MM, particularly those MM cell lines harboring RAS mutations representative of rrMM. We compiled >50 human myeloma cell lines (HMCLs) with broad genetic heterogeneity that represent innate drug-response/resistance, as well as 10 pairs of parental and clonally derived proteasome inhibitor (PI)- and immunomodulatory drug (IMD)-resistant HMCLs as models of acquired resistance. Using CRISPR-cas, we generated NRAS and KRAS mutants of drug-sensitive myeloma lines. We performed predictive analysis using single-cell RNA sequencing on all MM cell lines and demonstrated the potential efficacy of ADT-007 based on the subclonal expression of the target pathways. Using in vitro chemosensitivity assays, ADT-007 was highly effective in killing chemo-resistant and RAS-mutant myeloma cells with IC50 values ranging from 0.76 to 12 nM with synergistic benefits if combined with proteasome inhibitors. Caspase 3/7 assays confirmed apoptosis induction by ADT-007. We also investigated the cyclorasin B4-27, a bicyclic peptidyl that has shown potent pan-RAS inhibition against several other cancers, and RMC-6236, a multi-selective noncovalent RAS(on) inhibitor in a clinical trial for patients with activating Ras mutations. Pre/post-treatment single-cell transcriptomics analysis revealed a distinct shift in clusters representing myeloma single-cell subpopulations following ADT-007 treatment, including MYC, BCMA, & CCND1. We are now investigating the cytotoxic effect of ADT-007 in ex vivo patient samples. Our research lays the groundwork for future development efforts needed to advance ADT-007 into clinical trials.

Title: Automating grading on reading recall evaluation

Primary Author: Joaquin Sarmiento Naraza

Additional Authors: Alejandro Lazarte;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Evaluating the impact of factors on reading recall requires subjects to retrieve text under different conditions and may produce a sizable dataset. One of the most detailed scoring procedures is the Bovair-Kieras method, which demands extensive grader training and considerable time when grading an individual recall. Automating the grading process will accommodate a larger number of participants in any reading comprehension experiment. The present study attempts to generate an automated grading system for text recall using text mining and generative AI. For this study, grading was based on text similarity. The program developed uses the following approaches: Bag of Words (BoW), semantic similarity, and generative AI. It compares target vs recall text and provides an index of similarity. These scores were correlated with the text recall scores manually obtained following the Bovair-Kieras rubric. BoW provided the strongest correlation followed by semantic similarity and generative AI. Despite this, BoW only returns a high correlation when it handles readings with less parenthetical phrases. The repetition of exact words by the subjects gave BoW the best overall correlation. Generative AI performed more consistently, even when BoW got a better correlation on "easier" readings. Improvements to the generative AI are the most promising approach to the automation of the grading. The development of an automated text recall scoring system should generate a rubric like that of the Bovair-Kieras method. The OpenAI API can generate such a rubric, instead of simply comparing text similarity. This approach should produce a score more like the manual grading and give users more detail on how the grade was determined. This research presents different approaches to automating the grading of text recalls. A more scalable and precise program can build on these observations. The resulting system would be a viable tool for research, as well as for educational purposes.

Title: The generation of attosecond pulses to study electron dynamics

Primary Author: Jody Davis

Additional Authors: Swapneal Jain;Trevor Olsson;Gregory Young;Courtney Wicklund;Scott Chumley;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Ultrafast science is the study of physical phenomena at one of the shortest timescales observable in the modern world, possibly ranging from femtoseconds down to tens of attoseconds (where one attosecond is one quintillionth of a second). Electron dynamics are the physical processes of interest that typically occur in these durations, which have led to advancements in atomic, molecular, and solid-state physics in previous decades. Recent developments in short-pulsed light sources, extreme ultraviolet (XUV) radiation has been utilized to study these dynamic processes. Our group uses a technique called high harmonic generation (HHG) to generate coherent XUV pulses with durations in the attosecond timescale. To generate an attosecond pulse train, we focus high-power (up to 15 W), 35-fs laser pulses with a central wavelength of approximately 800 nm into a gaseous medium composed of argon. The electronic response of the argon atoms with respect to the incident laser beam is highly nonlinear and results in the generation of high order harmonics of the driving laser frequency. The high-energy harmonics generated from this process can result in corresponding photon energies of up to approximately 40 eV. Through use of different filters (aluminum and vanadium, 200 nm thick), we can “select” different energy harmonics to use for the subsequent study in ionization times of noble gases and pure metals.

Title: Variance in thermal tolerance between lines of eastern oysters (Crassostrea virginica) selected for resistance to Dermo disease

Primary Author: John Irwin

Additional Authors: Andrea Tarnecki;Scott Rikard;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: The eastern oyster (Crassostrea virginica) is an ecologically and economically important species with a range extending from the Gulf of Mexico to the Gulf of St. Lawrence. Cultured and wild oyster populations are significantly affected by Dermo disease, a condition caused by the protozoan parasite Perkinsus marinus. The impact of Dermo is expected to intensify with climate change, making the development of Dermo-resistant oyster lines a high priority. While genomic and phenotypic selection can improve resistance, selection for specific traits may lead to correlated changes in other important characteristics, such as temperature tolerance, that impact the resistant line's performance in changing climates. This study examined how genomic and phenotypic selection for resistance to Dermo disease affects the thermal tolerance of the eastern oyster. Four genetic oyster lines were evaluated: (1) an unselected wild control (FLWC), (2) a genomic control mated from oysters with average genomic estimated breeding values (GEBVs) for Dermo resilience and whole oyster weight (FLC), (3) a phenotypically selected line based on mating oysters that survived a Dermo laboratory challenge trials (FLP), and (4) a genomically selected line with high GEBVs for Dermo resilience and whole oyster weight (FLGS). A chronic LT50 (lethal time required to cause 50% mortality) assay was conducted by exposing oysters from all four genetic lines to temperatures of 23°C, 28°C, 36°C, and 38°C for 20 days. Mortality was assessed three times daily. Mortality exceeding 50% was observed only at 38°C; therefore, LT50 was calculated exclusively for this temperature. Survival analysis revealed that the LT50 (+/- .0977) of the FLGS line was significantly higher than that of the FLWC, FLC, and FLP lines. Results indicate that selection for resistance to Dermo disease did not negatively impact thermal tolerance. Instead, genomic selection significantly improved thermal tolerance.

Title: Survival, growth, and physiological responses of southern pine species to increasing salt stress

Primary Author: John Leopard

Additional Authors: Ajay Sharma;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Increasing salinity in coastal forest ecosystems, driven by saltwater intrusion and rising sea levels, is accelerating tree mortality and reducing growth. This study examines the survival, growth, and physiological responses of three southern pine species (longleaf, loblolly, and slash pine) to salt concentrations ranging from 0 to 3.5% (up to 35,000 ppm) in a controlled greenhouse experiment. Six-month-old and 18-month-old seedlings were exposed to saltwater treatments for 24 hours in a replicated randomized block design. One month after treatment, survival rates at the highest salinity level (3.5%) were 100%, 61%, and 92% for longleaf, loblolly, and slash pines, respectively. These rates decreased to 9%, 0%, and 9%, respectively, after three months, with survival increasing as salinity decreased across species. Root collar diameter (RCD) was significantly affected by salinity treatment in loblolly and slash pines but not in longleaf pine. Salinity did not affect plant height in any species. Chlorophyll fluorescence measurements indicated intensified salt stress with rising concentrations, with loblolly pines being the most affected. Salinity treatments also impacted dark respiration rates in all species, with respiration decreasing as salinity levels increased. Notably, younger seedlings (6 months old) exhibited greater resilience than 1.5-year-old seedlings across all species. These findings provide critical insights into the differential responses of southern pines to salinity stress, highlighting species-specific vulnerabilities and the potential implications for coastal forest management under rising sea levels and saltwater intrusion.

Title: Thermal variation mediated modulation of muscle stem cell populations of pre- and peri-hatch broiler chickens

Primary Author: John Rogers

Additional Authors: Jessica Starkey;Charlene Hanlon;Jeremiah Davis;Martha Sabine Rueda Lastres;Brittany Wall;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Satisfying temperature requirements of developing chicken embryos in commercial hatcheries is challenging. Our previous work revealed that meat yield was negatively affected when early-stage incubation (ESI) temperature decreased to 36.4°C (COLD) or increased to 38.6°C (HOT) from embryonic day (ED) 4 to 11 vs. maintaining 37.5°C (CTL) throughout incubation. The objective of this work was to assess the effect of thermal variation (TV) during ESI on muscle satellite cell (SC) heterogeneity in broiler chicks at transfer and hatch to improve our understanding of the mechanism responsible for altered meat yield in our previous study. Broiler breeder eggs were incubated at 37.5°C from ED 0 to 3. On ED 4, incubator setpoints were altered to match the COLD, CTL, and HOT TV treatments described above. On ED 11, all incubators were set to 37.5°C until ED 18 when eggs were transferred to hatchers. At transfer and hatch, pectoralis major (PM) and biceps femoris (BF) muscle samples were collected. Samples were stained to facilitate taxonomy of SC populations expressing the myogenic regulatory factors and SC markers, MyoD, Pax7, and Myf5, by fluorescence microscopy. Data were analyzed using SAS (ver 9.4) PROC GLIMMIX as a 1-way ANOVA with the PDIFF option at $P \leq 0.05$ to separate means. Tendencies were declared when $0.0501 \leq P \leq 0.15$. Chicks from HOT incubators tended to have the most Pax7+ SC in their BF muscle on ED 18 ($P = 0.1260$). On ED 21, HOT chicks had more MRF- nuclei ($P \leq 0.05$), tended to have more total non-fused nuclei, Pax7+ SC, and myonuclei in their PM muscle vs. CTL ($P \leq 0.15$). These results demonstrate that TV as little as 1.1 °C during ESI (ED 4 to 11) altered BF SC populations in modern, high-yielding broiler chicks at transfer and PM SC populations at hatch, though SC from functionally different muscles responded differently which sheds light on the mechanism by which suboptimal incubation conditions negatively impact broiler growth and meat yield.

Title: Quantifying arm swimming in the octopus Muusoctopus robustus

Primary Author: John Ryan McMichael

Additional Authors: Maria Florencia Breitman; Christine Huffard; Paul Roberts; Kakani Katija; Joost Daniels;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: The locomotion and object manipulation abilities of the octopus' hydrostatic limbs are backed with incredible dexterity and effective force, inspiring promising applications as a model for soft robotics. While research on octopus biomechanics tends to emphasize the versatility of their body and degree of freedom in their movement, we must consider that specific motions will be selected for if they confer fitness. These develop into a predictable set of actions and behaviors, and research has shown that practical actions like punching and tactile communication culminate in a finite number of efficient, stereotyped movements. Arm swimming, the propulsion gained from oscillation of all 8 arms, may provide an excellent model of stereotyped motion, but still lacks formal analysis. By measuring 138 arm angles throughout 14 minutes of arm swimming motion in 8 Muusoctopus robustus individuals, we can recognize and quantify variation and consistencies in movements to identify the underlying fitness and efficiencies of arm swimming in this species.

Title: Eyeblink conditioning and ADHD: a neurobehavioral approach to Pavlovian learning

Primary Author: John Walker

Additional Authors: John Falligant;Shane Phillips;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental condition associated with deficits in motor and executive functioning. While these symptoms are typically associated with dysfunctions in the prefrontal cortex and other brain regions, the cerebellum, which is crucial for motor coordination and timing, has been implicated as well. The cerebellum, however, has been underexplored regarding its contribution to cognitive and behavioral aspects of ADHD. Eyeblink conditioning (EBC), a Pavlovian learning paradigm that relies on cerebellar function, provides a powerful tool for investigating these mechanisms. EBC involves testing a simple reflex pathway and measures learning through conditioned responses (CRs) to a tone (conditioned stimulus, CS) that predicts an air puff (unconditioned stimulus, US), which elicits an eyeblink (unconditioned response, UR). The purpose of this literature review is to examine the relatively small number of studies investigating the link between cerebellar function and Pavlovian learning via EBC paradigms among subjects with ADHD. This review is important for determining: 1) whether ADHD and/or ADHD equivalent populations display different patterns of EBC learning from control subjects, 2) how specific procedural arrangements (e.g., CS duration, inter-US intervals) modulate EBC performance, and 3) a proposed structure for future EBC research in ADHD populations.

Title: Addition of self-assembling small molecules to cellulose hydrogels to enhance gelation and tune microstructure

Primary Author: Jordan Clemmons

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Chronic kidney disease (CKD) affects more than 1 in 7 U.S. adults (CDC), with 71% of these patients requiring dialysis (NIDDK). Dialysis significantly impacts patients' quality of life due to lengthy treatment sessions and added physiological stress. To provide an alternative treatment, we are developing orally ingested sorbent microgels that mimic dietary fiber by absorbing uremic toxins while simultaneously releasing probiotics. However, challenges such as prolonged gelation time and difficulty in achieving the optimal microstructure hinder their effectiveness. To address these issues, self-assembling small molecules can be incorporated into cellulose gels to fine-tune their microstructure, optimize pore size and geometry, and accelerate gelation. In this study, we investigate the gelation characteristics of FMOC, a pH-responsive small molecule, and its impact on cellulose-based microgel structure. When FMOC was added to a cellulose solution, gelation occurred instantly, demonstrating its potential to significantly reduce formation time. Since FMOC forms gels in a basic environment, NaOH was introduced, and gel behavior was monitored for over 180 minutes. Over time, the gels shrank and released fluid. This process was characterized using HNMR, where the suppression of FMOC peptide chain peaks indicated disruption of molecular interactions, contributing to the gel's structural changes. To evaluate temperature dependence, cellulose and FMOC were combined at both room temperature and 4°C. Results showed that chilling the gels improved their stability. Additionally, a time study was conducted using 3, 4, and 5 wt% cellulose to assess the effect of cellulose concentration on gelation. These findings suggest that small molecules like FMOC could effectively modulate microgel function. However, further investigation is needed to refine inconsistencies and establish potential improvements.

Title: Effects of genetic strain and diet on growth performance and Wooden Breast incidence in broilers

Primary Author: Jorge Luis Sandoval Escobar

Additional Authors: Jessica Starkey;Gerardo Abascal Ponciano;John Wesley Rogers;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Understanding the etiology of Wooden Breast (WB) in broiler chickens is crucial for developing nutritional or management strategies to mitigate its impact. To establish a reliable strategy to produce a market-weight broiler flock with normal fillets and 3 WB (mild, moderate, and severe), we previously found that feeding a diet with a 30% reduction in metabolizable energy, digestible Lys, and digestible Met (R) delayed but did not prevent WB in fast-growing birds (FG) compared to a control diet (C). To establish an unaffected control, we explored the feasibility of including a slow-growing broiler strain (SG). The objective of this study was to assess the BW, pectoralis major (PM) and biceps femoris (BF) muscle mass, and severity of WB in female SG and FG broilers both fed the C diet (FGC and SGC, respectively) plus the FG broilers fed the R diet (FGR). Birds were reared to 25 d post-hatch in raised-floor pens (4 per pen) and each day from d 7 to 25, 10 birds per treatment were weighed, euthanized, the WB severity was assessed by manual palpation and the BF and PM muscles were collected and weighed. Data were analyzed as a 1-way ANOVA using SAS (ver. 9.4) PROC GLIMMIX and PDIFF for mean separation at $P \leq 0.05$ and FREQ for WB incidence. Bird BW among broiler strains was similar on d 0 ($P = 0.5931$). On d 7 to 10, 12, and 16, FGC bird BW were the heaviest while SGC and FGR were similar ($P < 0.0001$). Though on d 11, 13 to 15, and 17 to 25, FGC birds were the heaviest, SGC were the lightest and FGR intermediate ($P < 0.0001$). From d 7 to 25, FGC birds had the highest and SGC had the lowest PM and BF muscle weights, respectively, with the FGR birds intermediate ($P < 0.0001$). The SGC birds had 100% normal breast fillets from d 0 to 25, while FGC birds were unaffected until d 16 and 100% WB-affected by d 19 ($P < 0.001$). Overall, these results indicate that SGC vs. FGC provides a feasible strategy for producing young broilers for research aimed at understanding WB etiology.

Title: A NEW METHOD FOR ESTIMATING CARBON STOCKS IN FOREST PLANTATIONS: IMPROVING ACCURACY WITH FEWER RESOURCES.

Primary Author: Jose Febles Diaz

Additional Authors: Haomin Huang;Favour Onyido;Emma Schopen;Zhaofei Fan;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: One of the biggest problems facing the estimation of carbon stocks at the scale of forest plantations is that an accurate estimate requires intensive use of human resources and difficult access to some areas. Current methods, such as forest inventory and remote sensing, have significant limitations. Forest inventory is a laborious method that requires the creation of plots and the measurement of forest metrics in the field, and from these, it is extensively assumed that all forests have the same characteristics. On the other hand, remote sensors, in the case of UAV LiDAR at the plantation scale, are the ones that provide the best results in this task, since they can provide information on height with high precision, and from this estimate the carbon; height being a variable with greater estimation power. The latter suffers from the problem that greater weight is given to the height variable, which can lead to estimation errors because the height is similar in mature trees and the width is the differentiating factor. In this context, a new method of parceling based on the diameter at breast height (DBH) distribution of the forest was proposed. An unsupervised technique was used to classify the DBH distribution into different classes and then specific curves were fitted for each class, using carbon stocks as the dependent variable and height as the independent variable. Preliminary results showed that this proposed method significantly reduced the estimation error, with an RMSE of 37.8 kg, which represents a 53% decrease compared to the model that only uses height as an input variable, whose RMSE was 80.84 kg. This innovative method has great potential to improve the accuracy of carbon estimation in forest plantations, as it does not require the use of other multispectral techniques or additional image sources, but is based solely on the flight of a LiDAR drone and a small field inventory.

Title: Effects of control Burns and Weather on Lecanosticta acicola Spore Dispersal in loblolly pine (Pinus taeda)

Primary Author: Joseph Anglin

Additional Authors: Lori Eckhardt;Emmanuel Nyarko;Jaden King;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Lecanosticta acicola is a foliar pathogen responsible for brown spot needle blight (BSNB), affecting the foliage of 53 Pinus species. BSNB spores are primarily dispersed through rain and wind events, particularly during warm weather. In longleaf pine (Pinus palustris), prescribed fire during the grass stage has traditionally been used to control BSNB. However, due to physiological differences, this method is not a viable control option for loblolly pine (Pinus taeda). To better understand the dispersal of L. acicola spores during weather events and understory prescribed fires, spore trap data was collected from a 9.5-acre, 26-year-old loblolly pine stand in Cullman, AL. Within this stand, BSNB symptoms were first observed in 2017. Fifteen spore traps were placed in an area designated for prescribed burning, while five were placed in an unburned control section. The prescribed burn was conducted in April 2024. Spore traps were collected weekly from March to November 2024. After collection, slides were examined under a compound microscope using a grid for positioning, and the presence and quantity of L. acicola spores were recorded. Weather data, including precipitation, was obtained from the Cullman National Weather Service station. Preliminary observations indicate a correlation between spore dispersal and precipitation levels. This study aims to clarify the relationship between spore load and environmental conditions within the stand, ultimately contributing to the development of forecasting models for BSNB spread.

Title: Brain age in PTSD: examining predicted age difference across trauma groups

Primary Author: Joseph Moore

Additional Authors:

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: Brain age has emerged as an important biomarker for assessing the effects of PTSD on brain structure. Previous studies have shown that PTSD is associated with reduced brain volume, suggesting accelerated brain aging. This study used brainageR, a regression-based approach in R, to estimate brain-predicted age from neuroimaging data and calculate predicted age difference (PAD) as the difference between brain-predicted age and chronological age. A positive PAD indicates that the brain appears older than the person's actual age. Neuroimaging data were acquired using a 7T Siemens scanner from three groups: PTSD, trauma-exposed without PTSD, and non-traumatized controls. Statistical analyses were conducted in R, using ANOVA to compare PAD across groups while controlling for sex. The results showed no significant differences in PAD among the groups ($F(2,76) = 0.278$, $p = 0.758$) or between sexes ($F(1,76) = 0.084$, $p = 0.772$). Tukey post-hoc tests further confirmed no significant pairwise differences. These findings suggest that PTSD may not be associated with significant differences in brain-predicted aging, though the lack of significance could be due to limited statistical power or sample size constraints. Future research should explore region-specific volumetric changes related to PTSD to capture potential brain aging effects better.

Title: Profiling the Placental Response: Interferon beta and Lipopolysaccharide stimulation of CT27 and CT29 trophoblastic stem cells

Primary Author: Joshua Baskaran

Additional Authors: Rachel West;Cristine Camp;Vicky Caravaggio;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Throughout pregnancy, the placenta acts as a key immunological mediator of maternal and fetal immune systems. During periods of immune-related stress, the placenta must successfully mobilize a Type 1 interferon response while also preventing an excessive inflammatory state. To better understand this delicate balance, this study tested the hypothesis that placental (trophoblast) stem cells mount differing levels of immune response to different immune stimuli. We used the CT27 (female) and CT29 (male) trophoblast stem cell (TSC) lines to evaluate the magnitude of immune responses to interferon beta (IFNB) and lipopolysaccharide (LPS) stimulation. TSCs were treated with 250u/mL IFNB or 1 µg/mL of LPS for 6 hours. After 6 hours, RNA was isolated, cDNA was synthesized and normalized to 500 ng/µL of cDNA, and qPCR was used to quantify levels of gene expression. We measured mRNA levels of the interferon-stimulated gene ISG15, interferon-induced transmembrane protein IFIT1, and C-X-C motif chemokine ligand CXCL10. There was significantly higher levels of ISG15 and IFIT1 in both the CT27 and CT29 TSCs stimulated by IFNB with CT29 cells exhibiting more statistically significant response (ISG15, $p<0.001$; IFIT1, $p<0.001$) compared to CT27 cells (ISG15, $p<0.05$; IFIT1, $p<0.05$). Interestingly, the cells stimulated by LPS had no significant differences in gene expression of any of the tested genes compared to control cells. Additionally, there were no differences in levels of CXCL10 in either the LPS or IFNB groups. In conclusion, both TSC lines exhibit a robust response to interferon stimulation which signifies the ability of both male and female fetuses to mount a strong response to IFNB. However, the TSCs failed to mount an immune response to LPS. These data suggest that placentas of male fetuses potentially mount a more robust innate response. Additionally, these findings provide evidence that the placenta is responsive to IFNB but not LPS stimulation.

Title: Insecticide Resistance in Alabama Poultry Litter Beetle Populations

Primary Author: Joshua Manganaris

Additional Authors: Dylan Brown;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Title: Insecticide Resistance in Alabama Poultry Litter Beetle Populations Primary Author: Joshua Manganaris, Additional Authors:Dylan Brown, Nannan Liu Department/Program: Entomology & Plant Pathology College/School: Auburn University Abstract: The poultry litter beetle, Alphitobius diaperinus, is a significant pest in the poultry industry, contributing to economic losses and posing risks to food safety and human health. Insecticides such as pyrethroids, organophosphates (OPs) and spinosyns are commonly used for beetle control in poultry houses. However, control failures have been reported in poultry houses across the southeastern United States, likely due to the development of insecticide resistance. To assess the extent of resistance, we conducted adult beetle bioassays on two Auburn poultry litter beetle populations, designated “Miller Center” and “Auburn Field”. We compared their susceptibility to permethrin, malathion, and spinosad against a laboratory-susceptible Danish population. The results revealed that both the Miller Center and Auburn Field populations exhibited moderately resistant to permethrin but remained susceptible to malathion and spinosad. These findings indicate that poultry litter beetles in Auburn Alabama have developed resistance to permethrin. Therefore, alternative insecticides such as malathion or spinosad should be considered for effective control of Auburn litter beetle
populations.

Title: The role of asparaginyl endopeptidase in frontal temporal dementia

Primary Author: Joyal Xavier

Additional Authors: Rajesh Amin;Sampada Tamhankar;Meenakshi Singh;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: TDP-43 aggregation is a hallmark of ~50% of Frontotemporal Dementia (FTD) cases, a subtype of Alzheimer's Disease and Related Dementias (ADRD). Normally, TDP-43 resides in the nucleus, but it mislocalizes to the cytoplasm in FTD and undergoes cleavage, producing aggregation-prone fragments. Asparaginyl Endopeptidase (AEP), a lysosomal protease overactivated in FTD, cleaves TDP-43 at its C-terminal domain, promoting aggregation. This specific cleavage makes AEP a critical therapeutic target. However, current AEP inhibitors lack specificity and cause kidney toxicity, highlighting the need for novel solutions. Our lab developed Compound C, a small-molecule inhibitor that blocks AEP's active site, prevents TDP-43 aggregation, and avoids kidney toxicity. To test its efficacy, HT22 hippocampal cells were treated with ethacrynic acid, a reactive oxygen species (ROS) inducer, to activate AEP. Compound C was co-administered, and AEP activation was assessed by Western blot. The reduction of TDP-43 cleavage was also evaluated by Western blot, and GFP-tagged TDP-43 cells were analyzed by immunofluorescence microscopy to assess aggregation patterns with the use of Compound C. Western blot results confirmed that Compound C reduced AEP activation and TDP-43 cleavage in ethacrynic acid-treated HT22 cells. Immunofluorescence revealed a marked reduction in TDP-43 aggregation in GFP-transfected cells treated with Compound C. Ongoing Seahorse assays aim to determine the effects of Compound C on mitochondrial respiration, offering additional insights into its therapeutic potential. This study highlights Compound C as a promising therapeutic candidate for mitigating TDP-43 pathology in FTD by targeting AEP activation and TDP-43 aggregation. Further experiments will provide insights into its ability to restore cellular homeostasis and support the development of targeted treatments for TDP-43 proteinopathies.

Title: Effect of sub-optimal temperature during late-stage of incubation on broiler chicken body weight gain and breast muscle growth characteristics

Primary Author: Juan Jose Barberena Baltodano

Additional Authors: Brittany Wall;Jorge Enrique Banegas Duron;Jessica Starkey;Charlene Hanlon;Jeremiah Davis;Wesley Rogers;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Previous work assessing the effect of thermal variation (TV) during late-stage incubation (LSI; embryonic day (ED) 11 to 18) found responses in carcass characteristics and breast meat yield. To understand the histological component occurring in these changes in Pectoralis major (PM) muscle growth characteristics, a randomized complete block design experiment with 3 TV treatments was conducted. Yield Plus ´ Ross 708 hatching eggs (n = 2,160) were incubated at 37.5 °C from ED 0 to 10. From ED 11 to 18, eggs were incubated at 1 of 3 air temperature set points: 37.5 °C (CTL), 36.4 °C (COLD), or 38.6 °C (HOT; n = 2 incubators per treatment). On ED 18, all eggs were transferred to baskets in hatchers set to 36.7 °C. Chicks were weighed and placed in floor pens (n = 6 replicate pens of 45 birds per treatment) and fed a common diet for 28 d. On d 7, 14, 21, and 28 post-hatch, a total of n = 20 birds per treatment were weighed, euthanized, and PM weights and samples for cryohistological analysis were collected. Data were analyzed as a 1-way ANOVA using SAS PROC GLIMMIX and PDIFF with mean separation at $P \leq 0.05$ and tendencies declared at $0.0501 \leq P \leq 0.10$. On d 7, the chicks from COLD incubators were similar in BW to CTL but were lighter and gained less BW from d 0 to 7 than those from HOT group ($P \leq 0.0146$). On d 14, both HOT and COLD chicks tended to be lighter than CTL ($P = 0.0694$) and gained less BW compared with those from the CTL incubators from d 0 to 14 ($P = 0.0746$). On d 7 chicks from COLD incubators had the lightest PM weight ($P = 0.022$) and on d 21 broilers from COLD incubators had lighter PM weights vs. CTL and HOT birds ($P = 0.033$). Broilers from COLD incubators tended to have the smallest PM fiber cross-sectional area ($P = 0.0564$) on d 14 and the smallest PM muscle cross-sectional area on d 21 which helps explain the reduced breast meat yield observed in our previous work and helps understand the effect of incubation temperature on post-hatch muscle growth.

Title: ADT-007: a novel Pan-RAS Inhibitor with a unique antitumor selectivity mechanism in pancreatic carcinoma models.

Primary Author: Junwei Wang

Additional Authors: Xi Chen;Khalda Fadlalla;Kristy Berry;Chung-Hui Huang;Yulia Maxuitenko;Sindhu Ramesh;Adam Keeton;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Approximately 90% of patients diagnosed with pancreatic ductal adenocarcinomas (PDAC) harbor KRAS mutations. These mutations activate KRAS to induce MAPK/AKT signaling, driving cancer cell proliferation and other aspects of tumorigenesis. The most common KRAS mutations are KRAS-G12D, G12V, and G12R, which are insensitive to FDA-approved KRAS inhibitors that are specific for the KRAS-G12C mutation, found in only 3% of PDAC cases. This leaves an unmet medical need for pan-RAS inhibitors to address the complex RAS mutational landscape of PDAC and other RAS-driven cancers. Our novel class of pan-RAS inhibitors, exemplified by ADT-007, potently inhibited pancreatic cancer cell proliferation in vitro with single-digit nM IC50 values and suppressed RAS activation and MAPK/AKT signaling. With its pan-RAS inhibitory activity, ADT-007 is expected to have greater efficacy and reduced susceptibility to adaptive or intrinsic resistance, such as reactivation of WT RAS or secondary RAS mutations, that limit the efficacy of FDA-approved KRAS-G12C inhibitors. ADT-007 has a unique mechanism of selectivity for RAS mutant cancer cells without significantly affecting the proliferation of wild-type (WT) normal cells. Based on the elevated expression of UDP- glucanosyltransferase enzymes we observed in RAS WT cells compared to RAS-mutant cells, we hypothesized that the mechanism of selectivity is attributed to enzymatic detoxification of ADT-007 in normal cells via glucuronidation. ADT-007 also shows superior antitumor activity over other investigational pan-RAS or pan-KRAS inhibitors to inhibit RAS-driven colony formation, by selectively inducing apoptosis. An orally available prodrug of ADT-007 (ADT-1004) exhibited favorable tolerance and produced sustained plasma concentration of ADT-007 significantly higher than 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: Improving Soundscape Ecology using an Affordable Device for Acoustic Monitoring and Environmental Sound Manipulation

Primary Author: Justin Hall

Additional Authors: Jonathon Valente;

Department/Program: ALA COOP Fish and Wildlife Unit

College: College of Forestry, Wildlife and Environment

Abstract: Scientists have recently begun to recognize the ecological and evolutionary roles of environmental sound. Sounds help wildlife find prey, avoid predators, locate resources, and communicate with one another. Meanwhile, rising anthropogenic noise (e.g. transportation, construction, and factories) threatens these natural soundscapes, impacting species' reproduction, survival, and behavior. This rise in soundscape ecology has been accompanied by advances in acoustic monitoring tools that have enabled researchers to assess species distributions, population densities, and conservation efforts. However, effective experimentation requires the ability to manipulate soundscapes and the combined use of broadcast and recording technologies remains underexplored due to the lack of affordable, integrated devices. To address this gap, we invented a Playback and Recording Device (PRD), a cost-effective ($219 per unit), weatherproof tool capable of manipulating environmental sound through audio broadcasts and recording environmental responses to those manipulations. The PRDs are made from off-the-shelf parts and instructions for building them will be open source. Preliminary tests indicate the units are highly reliable and can be left alone in the environment for up to 168 hours of broadcast and recording when powered by a 12-volt battery. This spring we will be deploying PRDs at numerous wildlife management areas throughout the state of Alabama to examine the effects of social information in habitat selection for species of conservation concern.

Title: Professors, policies, and artificial intelligence: Who's in charge?

Primary Author: Kailea Manning

Additional Authors: Katelyn Nelson;

Department/Program: Educational FLT

College: College of Education

Abstract: The increasing presence of artificial intelligence (AI) in higher education has prompted faculty to develop policies governing its use in the classroom. This study investigates the AI policies faculty are currently implementing and explores the key factors that influence these decisions, including perceptions of AI's benefits and risks, levels of AI literacy, and concerns about academic integrity, equity, and student learning. By examining these factors, this research seeks to answer the central question: What AI policies are faculty adopting in their classrooms, and what influences their policy decisions? To address this question, the study employs a mixed-methods approach that integrates both quantitative and qualitative data. Faculty members will be recruited through personal networks and social media platforms, including Facebook, X, Reddit, and LinkedIn. Participants will complete an online Qualtrics survey featuring Likert-scale and open-ended questions assessing their AI-related policies, perceptions of AI's role in education, and confidence in using AI tools for teaching and learning. In addition, participants who consent will be invited to take part in semi-structured follow-up interviews designed to capture deeper insights into faculty perspectives and provide quotes on the rationale behind their AI policies. The study targets faculty members from a variety of institutional types, including public and private four-year universities as well as two-year colleges, ensuring diverse representation across disciplines and teaching contexts. By examining faculty attitudes and decision-making processes regarding AI, this research aims to provide valuable insights into how higher education is adapting to the rapid evolution of AI technologies. The findings will contribute to ongoing discussions about best practices for AI integration in teaching, inform faculty development initiatives, and help institutions develop more effective and equitable AI policies. As AI continues to reshape higher education, understanding how faculty navigate this technological shift is essential for ensuring thoughtful and ethical implementation.

Title: Mus, Mitos, & Mammary Glands: Effects of heat stress during lactation on mitochondrial respiration.

Primary Author: Kailey Paul

Additional Authors: Wendy Hood;KayLene Yamada;Natalie Harris;Charlie Scharnatta;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Lactation is one of the most energetically demanding events in a female mammal's life. Female mammals can increase their sustained metabolic rate up to 7-fold, suggesting that mitochondrial performance is central to successful reproduction. However, the tissue-specific mechanisms supporting mammals' energetic capacity increase are currently understudied. This study focuses on how oxidative phosphorylation and the electron transport chain support increased energetic demand by measuring mitochondrial respiration in lab mice (Mus musculus) under standard conditions and a heat challenge. Furthermore, this study is among the first to utilize mammary tissue in mitochondrial respiration measurements. We hypothesized that exposure to high temperatures would inhibit mitochondrial performance, decreasing maximal respiration. Seven days post-gestation, experimental mice were moved to heat treatment (30C) or remained at standard temperature (22C). Processing occurred on the 12th day post-gestation. Mitochondrial respiration was measured in the maternal liver and mammary tissue due to their integral role in supporting lactation. Contrary to our hypothesis, preliminary data reveals no difference between the two groups in maximal (mammary: P= 0.95; liver: P= 0.41) or baseline respiration (mammary: P=0.84; liver: P= 0.19). Maternal and offspring body mass was significantly lower in 30C individuals (Maternal P = 2.22 x 10-5; Pup P= 1.69 x 10-7), indicating variation in nutrient allocation. Data on relative complex abundance and relative activity of the electron transport system complexes will be presented.

Title: My personal design process: A model for human-centered design & advocacy

Primary Author: Kaitlin Coyle

Additional Authors:

Department/Program: English

College: College of Liberal Arts

Abstract: A designer's "design process" is the most fundamentally important aspect of their profession; it is a roadmap used for solving wicked problems—those that often have no definite solution and require continual attention—to deliver effective, meaningful, and useful designs to users. Although most designers engage in the traditional "Design Thinking" process, often associated with the Hasso Plattner Institute of Design at Stanford (d.school), this poster is meant to depict my personal design process, and core values as a designer. In this poster, my design process is depicted in a non-linear, circular fashion—emphasizing the cyclical nature of design—with advocacy, feedback, collaboration, empathy, user testing, and human-centered design at the center. These concepts—my core values—inform the other stages of my process: 1) audience analysis, 2) UX Research, 3) defining problems & solutions, 4) developing content, 5) developing designs, 6) testing, and 7) implementing. By emphasizing my core values in each of the 7 stages, I ensure my end-product designs are human-centered, seeing people not just as tool users, but as humans affected by larger societal and contextual factors such as culture, language, geography, race, socioeconomic status, access to technology, etc. In turn, this also provides the opportunity for my designs to become a form of user empowerment and advocacy because of my emphasis on participatory design, including users at every stage of the design process, giving them a voice where they might not otherwise have one.

Title: Running for me or running for my child: How a parent's physical activity may be affecting their child's anxiety

Primary Author: Kaleigh Miller

Additional Authors:

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Childhood anxiety is becoming more prevalent globally as one in every five individuals under the age of 18 have an anxiety diagnosis. In the United States, 5.7% of all individuals will be diagnosed with anxiety in their lifetime—that is roughly 19 million people. Fortunately, studies have examined contributing factors to this rise in adolescents exhibiting anxious behaviors. Literature suggests that parents' behaviors and emotion regulation have a large part in their child's diagnosis. A parent's rejection, control, and social phobia can lead to increased childhood anxiety, while additionally mother's trait anxiety and father's overprotection can lead to increased anxiety symptoms in a child. Although literature has identified exercise training (such as running) as an intervention that improves individuals' anxiety symptoms, less research has examined how parents' own exercise habits are related to their children's anxiety. Therefore, the present study seeks to identify the mechanisms through which parental physical activity is linked with child anxiety symptoms. Parents who have a child between the ages of 5 and 18 with an anxiety diagnosis will complete a survey assessing demographics, their own physical activity level, the extent to which they model physical activity, their parenting behaviors, and emotional regulation and socialization. They will also report on their child's anxiety symptoms, temperament, and emotion regulation. Their survey responses will be analyzed, and a mediation model will be proposed (controlling for demographic factors) that highlights potential pathways in the association between parental physical activity and childhood anxiety. The results of the study will potentially inform family-based interventions as well as help parents navigate their child's anxiety symptoms.

Title: Characterization and collection of Ramularia isolates in Alabama cotton

Primary Author: Karamjit Kaur Baryah

Additional Authors: Amanda Strayer-Scherer;Zachary Noel;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Areolate mildew is an economically important disease of cotton in the United States, which is caused by two species of Ramularia (R. gossypii and R. pseudoglycines). One species, R. gossypii, has historically been the predominant species linked to areolate mildew in the southeastern United States, while R. pseudoglycines was only recently discovered in Mississippi in 2022. This research aims to determine the prevalence of two species of Ramularia associated with areolate mildew in Alabama cotton. Cotton leaves exhibiting symptoms of areolate mildew were collected from regions growing cotton in Alabama in 2023 (n=10) and 2024 (n=20). After fungal isolation, DNA was extracted from purified cultures. The ITS-rDNA, Actin, and Translation Elongation factor regions were amplified to identify the Ramularia species. Sequencing results showed that all ten of the isolates from 2023 were R. gossypii. In future experiments, we will test the sensitivity of these isolates to several commercial fungicides such as azoxystrobin, fluxapyroxad, mefentrifluconazole and pyraclostrobin. Assessment of Ramularia isolates and their reaction to various cultivars will help in establishing IPM recommendations for farmers to manage areolate mildew

Title: Empowering Autistic Individuals with Tailored Training and Innovative Learning Frameworks to Improve Cybersecurity Literacy

Primary Author: Karen Nix

Additional Authors:

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: According to CyberSeek, a project supported by the National Initiative for Cybersecurity Education Framework (NICE), a program of the National Institute of Standards and Technology (NIST) in the U.S. Department of Commerce, there are 400,000 plus cybersecurity jobs available in the United States. In efforts to address this gap, the NICE framework, designed to prepare professionals to be employable, describes tasks, knowledge, and skills to perform cybersecurity-assigned work. The most in-demand cybersecurity skills in the current market are solving problems, identifying hidden patterns and relationships, and mitigating cognitive biases. These skills are outlined in NICE. The ISC2 report notes that 90 percent of cybersecurity professionals see shortages in those skills. How the system is designed and built, a tiny segment of the population can fill cybersecurity work roles. By exploring an underserved population, we may discover that there is no shortage of skills. Among underserved communities, autistic individuals possess a strong skill set for mitigating cognitive biases, building mathematical models, and identifying hidden patterns. However, because Autism and other neurodevelopmental conditions are perceived as a disability that limits participation, these qualified populations are overlooked. The Bureau of Labor Statistics (BLS) reports that 85% of ASD individuals with a college degree are unemployed in the United States. If the proper toolbox is provided, autistic people can thrive in these roles. We propose a Digital Learning Framework that focuses on improving the cybersecurity literacy of autistic people. Several innovative technologies will be incorporated into this framework such as Virtual Reality (VR), Extended Reality (XR), and interactive Learning Management Systems (LMS) incorporating Game-Based Learning (GBL) and Video Modeling. By providing a safe and immersive experience through VR/XR simulations, we aim to enhance engagement and learning for those with cognitive disabilities. Using GBL and video modeling interactive content, we can accommodate different learning styles and preferences.

Title: Hormonal Regulation of Appetite and Metabolism: How Different Diets Affect the Endocrine System

Primary Author: Kaseleigh McCarley

Additional Authors:

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Specific digestive hormones, including glucagon-like peptide-1 (GLP-1), insulin, leptin, and ghrelin, are critical in regulating appetite, energy metabolism, and overall metabolic health. This study investigated the impact of dietary patterns on hormonal regulation and their association with metabolic disorders, including obesity, insulin resistance, and non-alcoholic fatty liver disease (NAFLD). Specifically, it focused on high-fat and Western-style diets and their adverse effects on hormonal balance, particularly by disrupting satiety signals and glucose metabolism. The findings indicated that high-fat diets suppress the production of GLP-1 and impair metabolic regulation, leading to leptin resistance, increased food intake, and weight gain. This report explores the impact of protein and fiber-rich diets on hormonal regulation, containing research by Dr. Michael W. Greene and other peer-reviewed studies. By examining the role of nutrient-dense diets, such as the Mediterranean diet, this study highlights their significance in facilitating hormonal balance and improving metabolic health. Through an integrative method that combines endocrinology and nutrition science, the research emphasizes the complex relationship between diet and hormone regulation, confirming its critical role in preventing chronic diseases and optimizing metabolic function.

Title: Paratrooper Injury Analysis of the Ankle and Foot

Primary Author: Kassandra Hileman

Additional Authors: Michael Zabala;Sierra Eady;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Paratroopers experience intense environments and unique dynamic loads during parachute landing falls (PLFs). A paratrooper can reach a velocity of up to 18 feet per second with the main parachute, and up to 27 feet per second with the reserve parachute. Due to these speeds, they experience a great risk of injury due to the high-stress and tactical nature of PLFs. It is estimated that 90% of paratrooper injuries originate with the impact of landing, and 19% of all injuries occur at the foot or ankle. The objective of this research is to perform an injury analysis of the foot and ankle by studying the biomechanics of the human body during a parachute landing fall. Subjects will perform three trials each of jumping from the ground and jumping off a box to simulate conditions like a PLF. Sensors like motion capture, force plates, pressure sensors, inertial measurement units (IMU), and electromyography (EMG) sensors are employed to collect data like ankle moment and angle, the average force magnitude of each foot upon impact with the ground, the distribution of the impact force on the area under the foot, acceleration of the foot and ankle, and the activity of muscles used for bracing when the feet hit the ground. The information from these sensors will be compared with a goal of isolating locations in the body at which the stresses are greatest during a PLF, and identifying the time during the PLF at which these stresses occur so that injuries can be minimized for our troops.

Title: A review of pharmacy vaccination services

Primary Author: Kassidy Scott

Additional Authors: Salisa Westrick;Oluchukwu Maureen Ezeala;Amatallah Saulawa;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Efficacious vaccination levels are important to prevent disease, death, and complications from comorbidities. Despite availability of vaccines, the uptake is not optimal. Pharmacists are one of the most widely available immunizers, and play a vital role in vaccination uptake. Understanding the vaccination processes pharmacists use can help identify areas that can be improved to enhance vaccine uptake. Most pharmacists have their own specific strategies they utilize when educating and vaccinating patients. This study aims to identify immunization processes, resources pharmacists utilize, counseling topics, and different success measures pharmacists use to measure success of their vaccination services. The recruitment is on-going. Pharmacists currently are recruited from the Rural Research Alliance of Community Pharmacies (RURAL-CP) network, the Harrison College of Pharmacy's alumni list, and the Alabama Hayes pharmacist directory. Semi-structured interviews will be conducted until saturation. Transcriptions will be thematically coded, and analyzed to identify patterns. Participants receive a $100 Amazon gift card as an incentive for participation. The first set of results demonstrate a similar process with a few small differences. Most pharmacists utilize their state's vaccination records to identify candidates, or they will wait for patients to come to them. Pharmacists mainly educate on two main topics: side effects of the vaccine and how the vaccines work. There are varying factors that pharmacists use to measure success. These factors include things from patient education to actual vaccination

Title: Effect of Rhizobial ACC Deaminase on Soybean Drought Tolerance

Primary Author: Kasun Thilina Wanninayaka Lansakara Jayasundara

Additional Authors: Yucheng Feng;Alvaro Sanz Saez de Jauregui;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: 1-Aminocyclopropane-1-carboxylate (ACC) deaminase, an enzyme produced by rhizobia, breaks down ACC, the precursor of ethylene, and reduces its inhibitory effects on plants during stress. Given soybean's susceptibility to drought stress, rhizobia with high ACC deaminase activity may offer a significant advantage under drought conditions. This study aimed to determine if rhizobia with high ACC deaminase activity enhance soybean drought tolerance. To accomplish this, Bradyrhizobium sp. strains 10 and 14, which exhibited high and low ACC deaminase activities, respectively, were used in this study. The greenhouse experiment consisted of a split-plot design with a randomized complete block design within. Water regimes (irrigated and drought) and inoculation treatments were the two main factors. The drought treatment started 70 days after planting and lasted 27 days. Plant physiological and growth parameters were measured during and after the drought period. The results showed that drought stress significantly reduced plant performance by decreasing biomass, nodule number and dry weight, photosynthesis rate, stomatal conductance, percent N derived from the atmosphere (%Ndfa), and carbon isotope discrimination ($\Delta^{13}C$). Under drought conditions, inoculation of Strain 10 significantly enhanced plant growth by maintaining higher chlorophyll a and b content and producing higher carotenoid, proline contents, and nodule mass. This study highlights the potential of rhizobia with high ACC deaminase activities to enhance soybean drought tolerance and support plant growth under water-limited conditions.

Title: Integrating Japanese aesthetics with sustainable biophilic interior design into the built environment of Carmel-by-the-Sea, California

Primary Author: Kate Clifford

Additional Authors:

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Design history is a complex combination of various styles and cultures adjusted to fit its appropriate location. Considering Carmel-by-the-Sea's rich history and precarious future, it is paramount that building materials are harvested sustainably. This evidence-based project explores the intersection between traditional Japanese and biophilic design principles to understand sustainability practices appropriate to non-traditional home design. The research examines the triple-bottom-line approach of sustainability methods and their integration into the built environment. Specifically, how sustainable design affects economic and social aspects of the designed environment. This project utilizes a systematic literature review focusing on peer-reviewed editorial publications (books and industry sources). The researcher synthesized findings through thematic analysis to categorize emerging themes and draw parallels for appropriate design elements. Foundational texts and sources include Cradle to Cradle and the works and design philosophies of architects Tadao Ando, Frank Lloyd Wright, and Philip Johnson. Traditional elements and principles of design, traditional building materials and methods, and traditional nature iconography residential Japanese design relies heavily on wood, negative space, natural light, and multi-functional rooms (harmony, balance, traditional elements such as conventional design principles). The researched elements within the aesthetics, design theories, and evidence-based design cohesively promote physical and mental wellbeing. A greater understanding of adapting traditional design philosophies to modern contexts can be achieved through the use of local materials and attention to local climate, landscape, and cultural heritage.

Title: Effects of donor cell type on channel catfish, Ictalurus punctatus, xenogen production

Primary Author: Kate Pottle

Additional Authors: Rex Dunham;Ian Butts;Hamza Dilawar;Nadeen Abdo;Parker Rae Menefee;Ahmed Elewa Shaaban;Misha Soman;Dhanuka Bambaranda Hewage;Baofeng Su;Mei Shang;Darshika Udari Hettiarachchi;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Hybrid catfish (♀ channel catfish, Ictalurus punctatus × ♂ blue catfish, I. furcatus) account for ~70% of the catfish production due to superior performance compared to the parent species for several traits. Xenogenesis has been utilized to potentially produce hybrid catfish embryos more efficiently by transplanting unsorted gonadal cells from donor diploid blue catfish into triploid channel catfish fry. Then xenogenic channel catfish males are mated with normal female channel catfish to produce 100% hybrid progeny. The stem cells have not undergone meiosis and are isogenic. This offers an opportunity to conduct reciprocal recurrent selection and identify the absolute best individual female channel catfish and male blue catfish that have the best combining ability, resulting in the ultimate hybrid progeny. The gonads of these individuals can essentially be 'cloned' and multiplied into large populations through xenogenesis, ensuring perpetuity without inbreeding and maintaining consistent performance of hybrid progeny. An impediment to this approach is that the brooders with the best combining ability are not identified until they reach maturity, at which point the number of gonadal stem cells is low, allowing for the production of only a few xenogenic progeny. However, if the spleen and kidney cells have colonizing and proliferation abilities, potentially 400 and 800 fry, respectively, could be injected from these donor organs alone. Triploid channel catfish surrogates were injected at 5 days post hatch (DPH) with either unsorted gonadal, kidney, spleen, or somatic cells (extracted from skin tissue) labeled with PKH26 fluorescence dye. PKH26 and PCR analysis indicated that 100.0, 90.9, 54.5 and 0.0 percent of fry injected with mixed gonadal, kidney, spleen and somatic (skin) cells were xenogenic. Theoretically, this would allow production of 1, 727, 218, and 0 xenogenic fry from gonad, kidney, spleen, and somatic cells, respectively from adult catfish. Colonization and proliferation of donor cells (predictors of future fertility) were evaluated using PKH26 by calculating percent cell (<150 μm2) and cluster areas (>150 μm2). At 45 DPH, gonadal xenogens had a larger cell area than the somatic (P = 0.004) and spleen xenogens (P = 0.031). By 90 DPH, gonadal (P = 0.003) and kidney surrogates (P = 0.029) had higher cell areas than spleen surrogates (P = 0.134). By 90 DPH, no fluorescent dye was found in somatic surrogates. Cell area for surrogates injected with gonadal (P < 0.001), kidney (P < 0.014), and spleen cells (P < 0.012) increased in size from 45 to 90 DPH. Cluster area also increased in size for surrogates injected with both gonadal (P < 0.001) and kidney cells (P < 0.002). Total cluster and cell area was highest for gonadal xenogens followed by kidney and then spleen xenogens. Kidney cells appear to be a viable option, and potentially spleen cells as well, for generating clonal populations of catfish to permanently fix maximum combining ability. Additional improvements could be achieved through cell purification.

Title: Characterizing immune cell development in Eucidaris Tribuloides

Primary Author: Katelyn Smith

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Cidaroidea is a primitive monophyletic subclass of sea urchin, sister group to Euechinoidea, the modern urchin. Fossil records have placed the emergence of this group ~270 million years ago during the Guadalupian epoch of the mid-Permian. Preliminary research has demonstrated that the process of embryogenesis of cidaroids differs from euechinoids in key aspects, particularly in regard to the differentiation of skeletal and non-skeletal mesenchyme tissues. There still exists, however, a major knowledge gap concerning the GRNs that drive the processes of embryogenesis in cidaroid urchins. I propose to stage the development of the cidaroid urchin Eucidaris tribuloides from fertilization to metamorphosis. Additionally, I aim to gain novel insights into the GRN controlling hematopoiesis with a focus on the differentiation of an adjacent population of mesoderm cells that give rise to immune cells. We will use in vivo imaging to define developmental stages and anatomical features. To study the GRN of this system, we will focus on gata1/2/3, gcm, and irf4, which have been implicated in S. purpuratus immune cell development. Gene expression will be localized using in situ hybridization chain reaction and further quantified through qPCR and RNA sequencing. Finally, regulatory connections will be confirmed using reporter constructs in which predicted transcription factor binding sites can be mutated. Finally, comparative methods will be used to assess the architecture of the E. tribuloides GRN in the context of echinoderm evolution. These methods will thoroughly examine the underlying processes of E. tribuloides development and immune cell differentiation.

Title: Human Impacts on the Water Quality of Lake Yojoa, Honduras through Time

Primary Author: Katelyn Waddell

Additional Authors:

Department/Program: Horticulture

College: College of Agriculture

Abstract: Lake Yojoa is the largest tropical lake in Honduras and is a staple in the country for consumable fish exports. The lake has suffered from serious water quality degradation due to several human activities that have altered the hydrological flow. Influences such as hydrological changes, new mining operations, and intensive tilapia aquaculture have increased nutrient levels, heavy metal contamination, and changes in sedimentation processes that promote the growth of harmful algal blooms (HABs). These HABs threaten the ecological health of the lake which harms the fish in the farm as well as the water supply for local tourism. A lack of historical data on these tropical lake systems has inhibited the identification of the primary cause of degradation. This research attempts to fill this gap by reconstructing the historical impacts of human activities on the water quality of Lake Yojoa with the use of paleolimnological methods. Our sediment core that was collected in January 2023 will be analyzed for key nutrients (carbon, nitrogen, phosphorus), heavy metals (mercury, arsenic, lead), and photosynthetic pigments (chlorophylls, carotenoids) to track changes in primary productivity and pollutant levels over time. By linking these results to historical human influences, my research intends to point out the specific roles of aquaculture and mining in nutrient enrichment and heavy metal contamination. It will investigate whether these inputs have served as the reason for the influx of HABs that are harming the nearby environments. The findings are expected to inform management strategies to mitigate further degradation, not only for Lake Yojoa but also for the conservation of lakes and waterways globally, providing insights that can help address similar environmental challenges worldwide.

Title: Roses are red, upside-down jellyfish are blue: Delineating pigmentation in Cassiopea

Primary Author: Katelynn Tucker

Additional Authors: Katherine Buckley;Megan Maloney;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Marine invertebrates display many diverse colors. While some of these coloration patterns are well understood at the molecular level, many mechanisms underlying specific coloration remain unknown. Recent research suggests pigmentation may be beneficial in periods of temperature stress, specifically in the upside-down jellyfish (Cassiopea sp.). This pigment, Cassio blue, is a novel chromoprotein characterized by Kringle and Frizzled cysteine-rich domains. We have identified several orthologs of Cassio blue within the C. xamachana genome; this project aims to identify which gene is responsible for the blue pigment in adults. RNA was extracted from a polyp, ephyra, adult blue laplet and adult brown appendage for reverse transcription to analyze mRNA gene expression. Real-time PCR was used to identify which genes are expressed at specific life stages. Genes expressed in blue tissue, but not other tissues, were cloned into inducible expression systems and electroporated into E. coli. If the gene is responsible for pigment production, induced bacteria should produce a blue color. Preliminary results indicate specific expression patterns associated with the blue appendages that are absent in other tissues. These data provide valuable information on the source of pigmentation in Cassiopea.

Title: Exploring factors influencing college students' reporting of antidepressant medication adverse drug reactions

Primary Author: Katherine Bailey

Additional Authors: Joy DeBellis;Caitlin Moore;

Department/Program: Nursing

College: College of Nursing

Abstract: Young adults aged 18-25 report high rates of mental illness, with anxiety and depression being particularly prevalent among college students. Antidepressant medications are commonly prescribed to manage these conditions, contributing to increased usage within this demographic. While these medications can improve quality of life, they are often associated with adverse drug reactions (ADRs). ADRs are undesired effects of a drug, with antidepressants commonly causing gastrointestinal upset, headache, drowsiness, and sexual dysfunction. Recognizing and reporting ADRs promptly is critical for optimizing treatment outcomes, yet the factors influencing college students' decisions to report ADRs remain underexplored. This study aims to identify factors affecting ADR reporting among college students taking antidepressants. A descriptive study design will be employed, using an online survey distributed via Qualtrics to college students currently prescribed antidepressants. The survey includes multiple-choice and open-ended questions to collect both quantitative and qualitative data. The survey examines participants' demographics, their understanding of antidepressant ADRs, education received about ADRs, and their experiences with reporting ADRs. Data analysis will focus on uncovering patterns and themes in behaviors related to ADR reporting among this population. Findings from this study are expected to provide insights into barriers of ADR reporting specific to antidepressant medications. This knowledge could help healthcare providers develop targeted educational strategies, empowering students to recognize and report ADRs effectively. By enhancing ADR management, these strategies may improve adherence to antidepressant treatment, reduce the impact of untreated ADRs.

Title: Species-Specific Zones of Influence and Bulk Density Trends Across a Pyrophytic-to-Mesophytic Gradient in a Long-Unburned Mixed-Woods Ecosystem

Primary Author: Kathleen Gabler

Additional Authors: Heather Alexander;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: In fire-prone forests, tree species influence the spatial structure of fuel beds, shaping fire behavior and ecosystem dynamics. Pyrophytic species, typically produce litter that promotes fire spread, while mesophytic species, contribute denser, more compact litter that retains moisture and resists ignition. This study examines how species-specific zones of influence affect litter bulk density, litter depth, and packing ratio across a pyrophytic-to-mesophytic gradient in a long-unburned mixed-hardwood stand at the Mary Olive Thomas Demonstration Forest in Auburn, Alabama. Litter samples were collected beneath six species—shortleaf pine (Pinus echinata) and loblolly pine (Pinus taeda) as pyrophytic species, southern red oak (Quercus falcata) and white oak (Quercus alba) as intermediate species, and sweetgum (Liquidambar styraciflua) and red maple (Acer rubrum) as mesophytic species. Results showed that white oak had the highest bulk density (0.08 g/cm^3) and deepest litter layer (7.99 cm), while pines exhibited lower bulk densities (0.061 g/cm^3) and shallower litter layers (6.1 cm). Packing ratios followed a similar trend, with southern red oak (0.0000465) and white oak (0.0000454) showing the highest values, while shortleaf pine had the lowest (0.0000307). Despite expectations that pyrophytic species would maintain more aerated and loosely packed litter, statistical analyses ($p > 0.16$) showed no significant differences among species. These findings suggest that prolonged fire exclusion has reduced the expected differences in fuel bed structure across the pyrophytic-to-mesophytic gradient. The accumulation and decomposition of litter in the absence of fire may be homogenizing bulk density and packing characteristics, weakening the positive feedbacks that maintain fire-dependent ecosystems.

Title: Comprehensive assessment of multiply maintained self-injurious behavior in a young girl with multiple neurodevelopmental conditions

Primary Author: Kayla Mann

Additional Authors: John Walker;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Self-injurious behavior (SIB) is a significant concern, particularly in individuals with intellectual and developmental disabilities, due to its potential for severe physical and social consequences. The functional assessment of SIB can be especially complex when the behavior involves multiple response and functional classes, often requiring a series of individualized assessments to identify the maintaining variables. This project documents the clinical application of multiple modifications to the functional assessment process to identify the variables maintaining various topographies of SIB in a young girl with Autism and Down Syndrome. After conducting a standard functional analysis, we implemented several design modifications and follow-up assessments, including pairwise, reversal, trial-based, and single-behavior functional analyses. These assessments were prescriptive in developing a function-based treatment tailored to the participant's needs. Results indicated that the participant's SIB was multiply maintained, highlighting the importance of individualized and comprehensive assessment strategies not only to understand the maintaining variables but also to inform the development of effective, function-based interventions.

Title: Spermatogenesis, hormonal fluctuations, and testicular gene expression changes in male blue catfish during 34 months of development

Primary Author: Kaylan Martin

Additional Authors: MacKenzie Tackett;Helen Montague;Luke Roy;Rex Dunham;Timothy Bruce;Ian Butts;Samitha Liyanage;Kyle Wood;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Male blue catfish (Ictalurus furcatus) are a commercially important species that when crossed with female channel catfish (I. punctatus) produce a hybrid that accounts for >50% of U.S. catfish production. Sperm collection from male blue catfish is a lethal procedure, so it is crucial to understand how age and seasonality impact sexual maturity for selection. The objectives of this study were to follow male blue catfish for 34 months to quantify changes in body morphometrics, sex steroid hormones, and testicular development and gene expression as fish age and mature. Male blue catfish (n=5) were sampled every other month from August 2021 to February 2024. Weight, length, and blood samples for hormone analysis were taken before lethal dissection of testes. Testes were weighed and a piece (~1 g) of testis was kept in neutral-buffered formalin for histological analysis. Additional testis samples (~1 g) were snap frozen in liquid nitrogen for RNA extraction. RNA was extracted and sent for sequencing. Bioinformatic analysis was ran to determine differential genes between ages and seasons. Gonadal Somatic Index (GSI) and the Spermatogenic Maturity Index (SMI) were calculated based on cell types found in histological samples at different developmental stages. We observed significant differences ($p \leq 0.05$) in body length, weight, and testes weight as fish aged. GSI and sex steroid hormone levels were the highest at Age 4 during the spawning season, indicating maturation and spawning readiness. SMI values indicated that as fish aged, sperm cells developed, and fish were sexually mature at Age 4. Differential genes (DEGs), implying maturity and gonadal development, were also expressed between ages 2, 3, and 4 when sampled during and out of spawning season, with the highest amount of DEGs expressed between Age 2 sampled in winter and Age 4 sampled in summer. These findings improve our understanding of maturation and development in male blue catfish throughout early ontogeny.

Title: Reclamation of polyolefins from multilayer plastic packaging waste

Primary Author: Ke Zhan

Additional Authors: Yucheng Peng;GiGi Sharp;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Multilayer plastic packaging (MPP) has been widely used for its excellent barrier properties, preventing spoilage and extending food shelf life. However, its complex structure and the susceptibility of barrier layers to thermo-oxidative degradation make traditional mechanical recycling unsuitable, causing economic losses, particularly for polyolefins, the primary component of MPP. In this study, the low-density polyethylene (LDPE) was successfully reclaimed by selectively dissolving and removing the ethylene vinyl alcohol (EVOH) barrier layer from an LDPE-based MPP film using formic acid as the solvent. The effects of solvent concentration, temperature, sample size, and solvent-to-sample ratio on EVOH dissolution kinetics were analyzed, and the properties of the LDPE reclaimed under optimized dissolution conditions were evaluated. The results showed that the reclaimed LDPE exhibited mechanical and thermal properties comparable to those of virgin LDPE. This study demonstrated that selective dissolution is an applicable method for MPP recycling and that the recycled material is reusable. Further research will focus on EVOH recovery from the solution.

Title: Efficacy of an In-house Pharmacist-Led Single Level Vancomycin Area Under the Curve Therapeutic Drug Monitoring Service in a Pediatric Hospital Setting

Primary Author: Keila Adams

Additional Authors: Taylor Jones;

Department/Program: Phamacy

College: Harrison College of Pharmacy

Abstract: The purpose of this research is to determine if the implementation of a pharmacy-directed vancomycin AUC therapeutic drug monitoring service is effective in a pediatric hospital. As vancomycin remains a mainstay antibiotic in the treatment of many infections, its dosing and monitoring methods have progressed. The use of trough-based monitoring methods exhibit increased trends in nephrotoxic events such as AKI. A revised consensus guidelines on the therapeutic monitoring of vancomycin strongly recommends the shift from trough-based methods to area under the curve/minimum inhibitory concentrations (AUC/MIC) therapeutic drug monitoring in the adult and pediatric population. The rationale behind this study comes from a lack of sufficient research and data in the pediatric population. This is a retrospective, single-center study conducted at the University of South Alabama Children's and Women's Hospital (USACWH), a 150-bed stand-alone academic institution in Mobile, Alabama. In September 2019, the USACWH Pharmacy started a new service to ensure every patient on routine vancomycin has their dosing regimen calculated and reviewed by a pharmacist. Prior to this, pharmacists were not responsible for dosing vancomycin. Data collection will compare information from 2 years prior to the implemented service in September 2019 to 2 years after the implemented service. A spreadsheet calculator was developed by the pharmacy team using the traditional Sawachuk-Zaske model following first-order pharmacokinetics with volume of distribution estimations. This spreadsheet calculator allows pharmacists to perform the necessary AUC calculations and interpret the data based on a single vancomycin trough level and population-based pediatric pharmacokinetics. Inclusion criteria include all USACWH patients < 19 years old treated inpatient with IV vancomycin for at least 48 hours. Exclusion criteria are neonatal intensive care unit (NICU) patients. Efficacy will be determined by lack of vancomycin-related acute kidney injury and time to therapeutic goal. This study is IRB approved by the University of South Alabama.

Title: Exploring the impact of perinatal anxiety and depression on breastfeeding practices: a study of women utilizing doula and midwifery services.

Primary Author: Kendall McCallum

Additional Authors: Katilya Ware;

Department/Program: Nursing

College: College of Nursing

Abstract: This study aims to investigate the relationship between perinatal mood disorders and breastfeeding practices. Initiation, duration, and exclusivity among women who have used a doula or midwife during pregnancy or childbirth in Alabama will be explored. Midwives and doulas provides support to women during, before, and/or after the birthing process. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, yet only 21% of women in Alabama meet this guideline, 5% lower than the national average. Previous research has shown that perinatal mood disorders can impact breastfeeding outcomes, but there is a gap in understanding their specific effects in Alabama, particularly among women who use doulas or midwives. This study will assess mental health status by exploring the connection between their mental health and breastfeeding practices. Participants will complete a 114-item questionnaire adapted from established mental health and breastfeeding instruments including PHQ-9, GAD-7, EDPS, and PRAMS. The anticipated sample size is 75 participants, and the minimum number of participants needed is 30. Data collection is currently underway and anticipate findings from this research providing valuable insights into whether perinatal mood disorders influence breastfeeding outcomes and the potential role of doulas and midwives in supporting breastfeeding initiation and continuation. The results will contribute to understanding how mental health and support systems impact breastfeeding practices, informing future interventions and healthcare recommendations.

Title: Tiny worlds, mighty impacts: unveiling the small intestine's microbiome in preeclampsia

Primary Author: Kenli Myers

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: This study will explore the role of the small intestine microbiome in the development and/or predictive value of a preeclampsia diagnosis. Preeclampsia is a pregnancy-induced hypertensive condition associated with significant maternal and fetal risks. Most research has focused on the large intestine microbiome due to the ease of sampling the feces, leaving a gap in understanding the small intestine's potential contributions to this condition. This prospective, observational study will recruit approximately 24 pregnant women diagnosed with preeclampsia in their third trimester, alongside a matched control group of 24 normotensive women. The recruitment will occur at local OBGYN offices and the East Alabama Medical Center, which has a higher-than-average rate of preeclampsia. The primary goal will be to survey and compare the microbiomes of the small intestine and large intestine in both groups using 16S rRNA sequence analysis to define microbiome profiles that may be reproducible within each group of pregnant women. The large intestine contents will be sampled by collecting feces, while the small intestine will be sampled using the SIMBA capsule. This capsule is a novel device with a pH-sensitive coating that dissolves in the small intestine allowing revealing an opening to sample the contents. The capsule closes upon entry to the large intestine and can be collected from the feces. Post-partum women will be administered the capsule 48 hours after delivery and will collect their bowel movements until the capsule is retrieved. Observing differences in the small intestine microbiota could lead to insights into the role of gut microbiome dysbiosis in preeclampsia and potentially establish a link between microbiome changes and prophylactic treatment strategies. In conclusion, this research will enhance the understanding of the small intestine microbiome's role in preeclampsia but also opens avenues for potential preventative strategies and probiotic interventions.

Title: Towards Understanding the Impact of Function Metrics on Symbolic Execution Timing

Primary Author: Kevan Baker

Additional Authors:

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: In the field of static program analysis, symbolic execution is a technique which can provide details of the state of a machine as if the machine was to run the subject program. While symbolic execution has many use cases, such as finding bugs or determining the reachability of code, in practice it can often fall short due to inherent limitations of memory and time. In this paper, we examine the issue of scalability of symbolic execution on real-world binary programs and analyze metrics and components of programs on a function-by-function basis. We examine functions from binary programs in an effort to identify relations between metrics and the time taken to symbolically execute a given function. Using a dataset of 1104 binaries, we leverage a framework for analysis to explore the functions within the dataset using various metrics. This paper also introduces research paths for discussion and future work in analyzing functions to identify and understand what might cripple the runtime of symbolic execution in an effort to improve the state of the art of symbolic execution.

Title: Impact of cellular biosignaling markers on cardiac function and longevity of the Ames dwarf mice

Primary Author: Keyi Liu

Additional Authors: Muralikrishnan Dhanasekaran;Preston Cook;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Current contentious scientific findings have revealed that the essential cellular components to promote a “controlled” formation of proxidants to consequently trigger the pro-inflammatory markers (putative biosignaling cascade associated with innate immunity) to reduce pathogens-mediated injury/insult, decrease the risk for tumor/malignancy which can consequently augment the lifespan significantly of animals and humans. Interestingly, numerous scientific evidence has become apparent associating mitochondrial impairment with aberrant innate immune responses. The heart, a vital organ in the body, plays an important physiological role in regulating the lifespan of animals and humans. Since aging is correlated with a gradual and continuing decrease in cardiac functions. There are not many valid in vitro/ in vivo chemically induced or genetic models presently existing to assess the biosignaling mechanisms associated with aging. Ames dwarf mice are phenotypically distinguished by small body size and delayed puberty (lack of anterior pituitary function, decreased growth hormone), live 49–64% considerably longer than wild-type animals from the same strain. However, the cellular biosignaling markers associated with innate immunity and protease activity in the heart of the Ames dwarf mice and its aged-match controls are unknown. Hence, in this study, the markers of oxidative stress, inflammation, apoptosis, and mitochondrial NADH content was measured in the Ames dwarf mice and its aged-match controls (6 and 20-months old). The current study has emphasized the critical functions of growth hormone deficiency in modulating oxidative stress as well as innate immune responses in the heart which substantially improved the scientific knowledge regarding the concept of aging.

Title: Environmental antimicrobial resistance threats to pollinators

Primary Author: Kiranmayee Bhimavarapu

Additional Authors: Laura Huber;Geoffrey Williams;Alinne Lima Rodrigues Santana Pereira;Pankaj Prakash Gaonkar;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Antimicrobial use in food animals contributed to the emergence of Antimicrobial Resistance (AMR) in the environment. Honey and pollen have been shown to be reliable bioindicators of environmental AMR. However, the interconnectedness of antimicrobial use in animals, AMR environmental contamination and the impact on pollinator health is unknown. This study aims to infer the mechanisms of AMR spread from the environment to its pollinator and the risk of pollinator disease due to exposure to AMR following the use of composted or fresh poultry litter as a fertilizer. Two high-tunnel greenhouses were divided into three subsets in this controlled semi-field experiment. Yellow squash was planted and fertilized with either fresh or composted poultry litter. Apis mellifera honeybee colonies were introduced when squash plants flowered. Soil, pollen and honeybee samples were collected 5 times within a period of 56 days. The relative concentration of antimicrobial genes (ARGs) and mobile genetic elements (MGEs) in all samples were compared between groups using qPCR. Bees were screened for the presence of pathogenic and opportunistic organisms. The metagenome of soil and bee samples from 3-time points were analyzed. Preliminary analysis revealed higher levels of ARGs and MGEs in fresh litter compared to compost using qPCR. Metagenomic analysis showed that foraging bees exposed to the fresh litter environment displayed a significantly different (PERMANOVA, $p = 0.001$) microbiome than those exposed to composted litter. Most notably, honeybees exposed to fresh litter had over 70% relative abundance of Bartonella sp (common but not core bacteria), while the genus had an abundance lower than 10% in bees exposed to composted litter. Isolation efforts corroborated the metagenomic observations, showing a drop in the number of isolated G. apicola (gut health biomarker) and a trend towards increase in opportunistic pathogens S. marcescens and E. coli after 21 days of exposure indicating a possible dysbiosis event. ARGs richness also increased in soil and bees exposed to fresh litter than those exposed to compost. Despite soil and foraging bees having drastically different resistome profiles (PERMANOVA, $p = 0.001$), soil and bees shared a substantial amount of ARGs. They shared 144 type-specific resistant genes, MLSb, polymyxin, bacitracin, and tetracycline being the most shared genes between soil and the bees. Both fresh and composted litter increased the diversity of ARGs in the soil and the honeybee microbiome, but raw litter fertilizer did so at a higher rate. Fertilizing crops with either fresh poultry litter or compost contaminates the environment with AMR. Foraging bees in contact with these fertilized crops experience an impact on their overall microbiome and, consequently, an increase in opportunistic organisms that could cause disease and mortality. The overlap between soil and bee ARGs indicates horizontal gene transfer across environments. Our future studies will investigate the direct transmission of ARGs from fertilized soil to pollen and honeybees through whole genome sequencing of shared organisms. We will also explore the direct effect of antibiotic residues on AMR emergence and spread.

Title: Assessing IRIS films in Alabama Blackland prairie soils for wetland restoration

Primary Author: Kristen Cartee

Additional Authors: Thorsten Knappenberger;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Wetlands are ecosystems that play a crucial role in maintaining biodiversity, water quality, flood regulation, and carbon storage. Since the mid-1700s, about half of the wetland area in the United States was drained, but preservation of remaining wetlands has been possible with the Clean Water Act. The USDA Natural Resources Conservation offers the Wetland Reserve Easement (WRE) program, which aids landowners in protecting and restoring wetlands; however, these wetlands must be identified for participation in the program. Soils in the Blackland Prairie Region lack manganese and iron oxides, making it difficult for soil scientists to determine whether these soils are hydric. A lack of field indicators for hydric soils may falsely categorize a soil as non-hydric. The objective of this project is to find out if Indicators of Reduction in Soils (IRIS) devices can be used in the Blackland Prairie Region to confirm wetland soil conditions. IRIS devices, which are plastic films that are coated with iron (Fe) or manganese (Mn) oxides, are installed into the soil for 4 weeks. Under anaerobic soil conditions, soil microbes reduce the Fe and Mn coatings from the IRIS devices, which confirms wetland soils. A field site in the Blackland Prairie Region that has problematic soils and produced Fe and Mn IRIS films that were installed at the site was identified. The percent coating removal of each film was determined via image analysis and evaluated following IRIS protocol (removal of a 15 cm section of at least 30% of the coating within the top 30 cm of the soil). The soil texture of each transect in distinct layers was determined. The soil samples from each layer were analyzed using FTIR (Fourier transform infrared spectroscopic). The manganese films in the first installation were found to be reduced according to IRIS protocol. This result provides insight into the use of IRIS devices as a tool for wetland delineation, with possible refinement in the future.

Title: Novel marine bioactives in gastrointestinal therapy: bridging nature and medicine

Primary Author: Kristina Sullivan

Additional Authors: Suhrud Pathak;Muralikrishnan Dhanasekaran;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Gastrointestinal (GI) disorders encompass a wide range of pathological conditions affecting the digestive system (mouth through anus), including xerostomia, constipation, diarrhea, and irritable bowel syndrome (IBS). These GI disorders are characterized by symptoms such as pain, bloating, nausea, and altered bowel movements, which can significantly impact quality of life leading to early fatality. With a global prevalence of approximately 40%, GI disorders affect individuals across all demographics and are influenced by various biological, psychological, and physiological factors, including genetics, diet, mental health, and disruptions to the gut microbiome. The existing therapeutic approaches are pharmacological (the primary treatment) and alternative medicines (natural bioactives). While effective in alleviating symptoms, these medications can lead to adverse drug reactions such as nutrient malabsorption, limited long-term use, and potentially harmful toxic effects. Consequently, there is growing interest in natural and organic medicinal alternatives to reduce the pathology and improve the symptoms. This scientific review explores the pharmacological potential of marine bioactive compounds as prophylactic and therapeutic agents for common GI disorders, specifically diarrhea, constipation, and IBS. Bioactives derived from red marine algae, microalgae, and Holothuria leucospilota polysaccharides (HLPs) have demonstrated promising pharmacodynamic potential with fewer adverse effects compared to conventional treatments. Despite their potential medicinal benefits, further research is necessary to fully elucidate their mechanisms of action, efficacy, and safety. This scientific review highlights current findings and identifies key areas for future studies to advance the development of marine bioactives as viable treatments for GI disorders.

Title: Key Drivers of Alcohol Addiction Among Auburn College Students and Its Profound Impact

Primary Author: Kyeongseo Park

Additional Authors: Minseo Kang;Sunghyun Kim;Sumin Kang;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Excessive alcohol consumption among college students is driven by factors such as peer pressure, social drinking norms, academic stress, and easy access to alcohol, all contributing to addiction risks. Aaron White reports that 60% of full-time college students drink, and 30% binge drink monthly (White, 2013). Binge drinking at college parties not only leads to physical fatalities but also amplifies mental health issues. Patel's research reveals that 40% of suicides linked to depression and anxiety involve excessive alcohol consumption (Patel, 2007). This virtuous cycle of alcohol abuse damages both physical and mental health, leading to further addiction and distress. The purpose of this study is to explore how Auburn University students perceive and engage in binge drinking and how they are influenced by alcohol addiction. Additionally, it is important to understand which factor contributes the most to alcohol consumption and addiction among Auburn college students. The excessive alcohol consumption increases alcohol injuries, mental health problems, and academic decline. The study will focus on which factor, such as social, psychological, and environmental influences, is the most relevant cause to student alcohol consumption leading to serious health problems. The study will conduct a Focus Group Interview (FGI) with around ten Auburn university students, consisting of five males and five females, to explore their alcohol consumption. This will be analyzed to determine which factors influence drinking behaviors the most, and examine the potential side effects of alcohol addiction among Auburn university students. Furthermore, it will provide the insights of how students are influenced to drink alcohol during college periods. Moreover, it will determine better understanding to help effective strategies of intervention of alcohol abuse among college students.

Title: PATERNAL IMPACTS ON INDUSTRY-RELEVANT OFFSPRING PERFORMANCE TRAITS USING BLUE CATFISH, Ictalurus furcatus, CRYOPRESERVED SPERM

Primary Author: Kyle Wood

Additional Authors: Ian Butts;Xu Wang;Luke Roy;Rex Dunham;Ying Zhang;Samitha Liyanage;Kaylan Martin;MacKenzie Tackett;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Catfish farming accounts for ~70% of total U.S. finfish aquaculture production with the channel catfish (Ictalurus punctatus) female by blue catfish (I. furcatus) male hybrid constituting ~53%. Issues persist with male blue catfish used to create hybrids due to variable sexual maturity and a lethal sperm collection procedure. Great variability has also been observed between sperm quality, cryopreservation success, and offspring performance from specific sires. Our objectives were to (i) examine parental contributions to larval morphological development, hatch, and survival throughout early ontogeny using cryopreserved sperm, and (ii) identify fatty acids that predict sperm quality and cryotolerance to support hatchery production. Sperm samples were collected from 44 males, aliquots from each male were used for evaluation of fresh and cryopreserved quality (i.e. sperm kinematics, health indices, fatty acids). Cryopreserved sperm were thawed, crossed with 3 channel catfish females, creating 44 hybrid families reared in triplicate (n = 50 fry/tank). Hatch was quantified, then weights, morphometrics, and survival were collected at 0, 20, and 40 days post-hatch. Our results show that maternal effects (variance ≥20.8%) contributed significantly to offspring performance, with paternal effects (variance ≥2.7%) becoming significant later in ontogeny. There were also significant relationships (R2 ≥0.23) between paternal reproductive performance indices (i.e. morphometrics and sperm quality parameters) and offspring performance. Significant differences in 14 fatty acid concentrations were detected between fresh and cryopreserved sperm. More specifically, “good males” (faster and more motile cryopreserved sperm) had lower levels of monoenes and n-6 PUFAs pre-cryopreservation compared to males with slower and less active sperm. Further results will be presented. This research is critical for supporting the U.S. catfish industry to improve efficiency and production of hybrids.

Title: Effects of habitat management on avian communities across Alabama's state lands: implications for targeted management using conspecific attraction

Primary Author: Kylie Blake

Additional Authors: Jonathon Valente;Justin Hall;Lucas Parvin;

Department/Program: ALA COOP Fish and Wildlife Unit

College: College of Forestry, Wildlife and Environment

Abstract: Habitat change and fragmentation are major threats to bird populations globally. Alabama supports over 150 species of breeding birds despite less than 5% of the lands being protected from broad scale landcover changes. Effective land management is critical to provide target species with accessible and suitable habitat. From 2008-2010, the Alabama Department of Conservation and Natural Resources (ADCNR) sampled breeding bird communities on wildlife management areas (WMA) around the state and implemented targeted land management strategies to improve habitat for breeding birds. In this study, we re-sampled bird communities using nine WMAs as study areas to evaluate these strategies' effects and identify target species for social information research on habitat selection. Across all nine WMAs in 2024, we sampled 603 point count stations, recording 26,545 detections of 104 species. The most common species were red-eyed vireo (Vireo olivaceus; 74% of sites), northern cardinal (Cardinalis cardinalis; 85%), and tufted titmouse (Baeikophus bicolor; 82%). According to Alabama's Wildlife Action Plan, 28 species are of greater conservation need in the state, and three were detected in 2024: American kestrel (Falco sparverius Paulus), Bachman's sparrow (Peucaea aestivalis), and cerulean warbler (Setophaga cerulea). Based on preliminary results, we identified four species for our habitat selection study: Bachman's sparrow (BACS), northern bobwhite (NOBO; Colinus virginanus), southeastern American kestrel (AMKE), and prairie warblers (PRAW; Setophaga discolor). These species were selected for their state conservation status (MAKE and BACS), game species importance (NOBO), role as biodiversity indicators, state-wide prevalence, and phylogenetic heterogeneity. NOBO, BACS, and PRAW were primarily detected in southern Alabama, while AMKE were exclusively detected in northwest Alabama. Future research will examine specific links between local habitat management and changes in bird communities over the past 15 years, and target Perdido River, Geneva, and Blackwater WMAs to evaluate habitat selection mechanisms using audio playback devices.

Title: Finding the T6SS ‘needle’ in the ‘haystack’ of Xanthomonas genomes using bioinformatics

Primary Author: Kylie Weis

Additional Authors:

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: With whole genome sequencing becoming a prevalent research technique, the wealth of data available for study is growing exponentially in the field of microbiology. This resource is not only able to be used for population genomics but can also be leveraged to answer questions in molecular biology. One such question is finding the effector repertoire of the type six secretion system (T6SS) in the plant pathogen, Xanthomonas perforans. Unlike the type three secretion system, there is no universal secretion system signal found within the sequence of T6SS effectors. This presents a challenge in identifying new effectors computationally. To address this problem, this study aims to develop a computational pipeline for the discovery of new effectors. First, genomes are downloaded from the NCBI database and undergo a BLAST search for the core genes TssA and TssB which flank the T6SS gene clusters. This identifies the genomic region which is then annotated with Bakta and used to search for genes within the cluster, as these close proximity genes are effector candidates after excluding known core and regulatory genes. After extracting this region from the genome, the remaining portion will be searched using the HMMER algorithm for orphan effectors using known effectors in other bacterial species, VgrG, PAAR domains, and DUFs known to be associated with T6SS effectors. Once a list of putative T6SS effectors is formed, the effectors will be characterized using Google’s AlphaFold, Foldseek, PaperBLAST, and multiple annotation softwares. The information gleaned from these analyses will be used to reveal the potential physical limitations of the T6SS through effector similarities such as effector structure, charge or unfolding force and may reveal secretion size limitations. This study not only exposes the effector diversity of Xanthomonas but also serves to show the potential for genomic data to be useful in addressing questions in molecular biology.

Title: The Impact of Dietary Supplements on Psychological and Physiological Symptoms of Premenstrual Syndrome and Premenstrual Dysphoric Disorder: A Systematic Review

Primary Author: Laura Robinson

Additional Authors: Madison Mattingly;Aidan Cavanah;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Background: PMS and PMDD are menstrual cycle-related disorders that significantly impact women's quality of life, with incidence rates fluctuating globally, including a 59.6% increase in the United States since 1990. While selective serotonin reuptake inhibitors and combined oral contraceptives remain primary treatments, interest in dietary supplements as non-pharmaceutical alternatives is growing, but rigorous research is needed to establish their efficacy. Method: This systematic review examined the effects of nutritional interventions on psychological and physiological PMS symptoms in women of reproductive age. A comprehensive search of MEDLINE, PubMed, Scopus, and Cochrane databases identified RCTs published from 2005 to 2024. Eligible studies were screened, extracted, and assessed for bias using the Cochrane RoB2 tool, with data on study design, sample size, intervention type, duration, and outcomes. The protocol was registered in PROSPERO (CRD42024558451). Results: Thirty-three RCTs involving women aged 15–50 years (n = 4,312) were narratively reviewed. Six studies had a low risk of bias, 22 had some concerns, and six were at high risk. Vitamin B6, calcium, and zinc consistently improved both psychological and physiological PMS symptoms, with similar results observed for Sèrèlys (pollen extract). Whole grain and dietary calcium interventions significantly improved PMS severity and quality of life. However, 13 studies evaluating other supplements—including vitamin D, hydrogen-rich water, Vitex agnus-castus, curcumin, fish oil, and saffron—reported mixed results or no significant findings when comparing interventions to placebo groups. Conclusion: Nutritional interventions show promise for PMS symptom relief, but variability in study quality and methodologies limits definitive conclusions. Further high-quality, standardized trials are needed to confirm their efficacy and clinical application.

Title: Enhancing Sustainability in Additive Manufacturing: Bio-Based Phenol-Resorcinol-Formaldehyde Resins for Construction Applications

Primary Author: Laura Vanessa Alvarez Marin

Additional Authors: Tawsif Rahman;Soledad Peresin;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: The rapid advancement of additive manufacturing, particularly three-dimensional (3D) printing, has revolutionized the construction industry by improving efficiency, minimizing material waste, and reducing costs. However, conventional building materials, such as concrete, contribute significantly to global carbon emissions, highlighting the urgent need for more sustainable alternatives. One promising approach involves replacing petroleum-derived resins with bio-based materials, reducing environmental impact while maintaining structural performance. In this study, we investigate the partial substitution of commercial phenol-resorcinol-formaldehyde (PRF) resin with bio-oil to improve the curing profile and flowability of the material, enhancing processing during extrusion in 3D printing. Cascophen™ 4001-8, the base resin, was partially replaced with bio-oil, while Cascoset™ 5830 was used as the hardener, maintaining a resin-to-hardener ratio of 2.5:1. The bio-oil was integrated based on dry basis composition and the mixtures were subjected to pre-treatment at temperatures ranging from 50–110°C to enhance mixture homogeneity and promote polymerization. A full factorial experimental design was implemented to evaluate the effects of pretreatment temperature and mixing sequence on resin curing, assessed through mass loss measurements. The bio-based PRF resin was combined with wood flour in a 50:50 ratio to fabricate particleboards, which were pressed at 180°C for 5 minutes. Characterization included flexural testing (ASTM D1037-12), water absorption, and swelling to assess mechanical and dimensional stability. Additional analyses included solvent resistance to evaluate resin stability, FTIR to identify functional groups, and viscosity and gel time measurements to assess curing kinetics. Preliminary results indicate that incorporating bio-oil enhances resin performance while reducing reliance on fossil-based phenol. These evaluations provide a comprehensive understanding of wood-PRF-bio-oil composite's structural performance and its potential as a viable, sustainable material for additive manufacturing in construction.

Title: Designing studio classrooms for Generation Z: Enhancing focus through immersive virtual reality

Primary Author: Lauren Fendley

Additional Authors:

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Generation Z (Gen Z), born between the mid-1990s and early 2010s, is the primary demographic of current college students. As the first generation to grow up with constant internet access, Gen Z is accustomed to short-form content and immediate answers, contributing to shorter attention spans compared to previous generations. This shift presents challenges in maintaining student focus in higher education settings, particularly in design studios. Given Gen Z's tendency for reduced attention spans, there is a critical need to design classrooms that enhance focus and engagement in studio-based learning environments. This research explores the impact of evidence-based classroom design on student focus in design studio settings, proposing optimized spatial configurations to support cognitive engagement. The study tests three studio classroom prototypes using immersive virtual reality (VR) technology. Participants will explore these environments in VR while listening to an audio lecture. Their comprehension and focus will be assessed through a task-based evaluation following the lecture. This study addresses the pressing challenge of educating a generation with evolving cognitive behaviors. The use of VR provides a controlled and immersive evaluation of classroom designs, ensuring precise participant responses. Findings from this research will inform higher education administrators and classroom designers on strategies to enhance student focus and well-being. Additionally, this study contributes to understanding how physical learning environments affect cognitive function, demonstrating the potential of emerging technologies in design and education research.

Title: Development of a Novel Bead Reactor for Nutrient Remediation of Wastewater

Primary Author: Lauren Fort

Additional Authors:

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: To adequately treat nutrient dense wastewater, new approaches to the remediation of nutrient pollution from wastewater are needed. A synthetic microalgae-bacterium consortiumprotected in an alginate bead structure has been developed to do so. The alginate beads provide a safe environment for the metabolic processes of the microbial consortium allowing high absorption rates of nitrogen and phosphorus from wastewater. Preliminary bench-scale values in batch reactor mode have been determined for the alginate bead production process under various manufacturing rates to test reactor performance and to establish a controlled baseline. However, to scale up the process, a deeper understanding of the characteristics and limitations of the beads through continuous mix reactors in aquaculture wastewater is required. To do so, beads will be produced with and without the microbial consortia, tested under varying operating conditions of water chemical composition, temperature, and age of beads for density, settling time, buoyancy, porosity, and settleable solids and compressibility. An analysis of these results will allow for the delineation of the parameters of the alginate beads and their sustainability under operational conditions typical of aquaculture wastewater remediation.

Title: A content analysis of adaptive period underwear and reusable pads for people with physical disabilities

Primary Author: Lauren Lansdell

Additional Authors: Jia Wu;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Women with mobility impairments, such as wheelchair users, often experience difficulties with menstrual care depending on the severity of their disability. Discomfort from prolonged sitting, can cause pads to shift, resulting in leakages and staining of their clothing. Additionally, the process of donning and doffing their underwear can become difficult. Depending on their mobility or dexterity issues, a caregiver is sometimes required, leading to frustration, embarrassment, and low self-esteem. The purpose of this study was to determine the challenges and success of period underwear, adaptive underwear, and reusable pads available to consumers by examining the product reviews through a content analysis of 15 brands. The first 10 quality consumer reviews were saved and analyzed from approximately 110 products using the FEA Consumer Needs Model as a framework. The FEA model was developed to help design for a specific consumer by defining the situational needs of the garment (Functional), how the consumer wants to be perceived (Expressive), and the design elements incorporated into the garment (Aesthetic). Eight themes emerged for functional needs (mobility, protection, stability, comfort, absorbency, odor control, and position/size of the pad), three for aesthetic needs (color, pattern, and style), and three for expressive needs (self-esteem, mood enhancement, and sustainability). The remaining parts of the study will include interviews of women with disabilities to determine the challenges they face with period products. Thus, allowing us to design and develop a variety of adaptive period underwear and reusable pad prototypes that will help address the challenges women with disabilities face with period products.

Title: Thermoregulatory Responses to Fat Intake and Vitamin Supplementation in C57BL/6J Mice

Primary Author: Lauren McGinness

Additional Authors: Braeden Heath;Mehrnaz Abbasi;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Obesity, a pressing global health issue, has been associated with deficiencies in several vitamins, including A, D, C, B1, and B5, as reported in previous research. This study investigates the effects of multivitamin supplementation and dietary fat intake on thermoregulation in mice. The mice (n=25, 4 weeks old) were randomly assigned to five groups and fed food with varying fat content over a 6-week period: (1) control chow diet (CD, 18% fat), (2) control low-fat diet (LFD, 10% fat), (3) control high-fat diet (HFD, 45% fat), (4) LFD diet with supplementation (LFD + V), (5) HFD with supplementation (HFD + V). Weekly measurements of food intake and body temperature were recorded. At the end of the 6-week period, the core body temperature and surface skin temperature were measured. The results showed a significant difference between the supplemented and control groups, with a positive correlation between weight gain and thermogenesis. HFD mice and HFD + V mice had lower Tskin values than the control groups at room temperature and 4°C. The LFD, LFD + V, and CD mice had stable Tcore and Tskin temperatures at 36.4°C. At 4°C, the HFD group showed greater reductions in Tcore and Tskin than other groups. The LFD and LFD + V mice had an overall lower Tcore after 1 hour at 4°C but recovered to a stable temperature of 36.8°C within four hours. Obesity negatively impacts thermoregulation, while vitamin supplementation and low dietary fat content have been shown to potentially moderate the adverse effects of obesity.

Title: Navigating the digital body: interoception as a mediator between social media consciousness and suicidality in individuals with disordered eating

Primary Author: Lauren Pictor

Additional Authors: Rylee Lusich;Marley Billman Miller;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Social media platforms play a significant role in shaping body image by fostering appearance-related social media consciousness, which in turn, predicts body dissatisfaction and disordered eating in young women and girls. Appearance-related social media consciousness (ARSMC), defined as an ongoing awareness of how one's appearance might be judged by a social media audience, is linked to body dissatisfaction and disordered eating behaviors. One mechanism for this relationship may be interoceptive sensibility. Specifically, focusing on one's social media related appearance may decrease one's ability to sense and regulate their internal sensations, thereby worsening their interoceptive sensibility. Such interoceptive deficits are implicated in maladaptive behaviors such as disordered eating and suicidality, suggesting that a disconnection from the body facilitates harmful behaviors. Thus, we predicted that interoceptive sensibility would mediate the relationship between appearance-related social media consciousness and suicidal ideation in individuals with disordered eating. A sub-sample of 224 college students that indicating elevated levels of disordered eating via the Eating Pathology Symptoms Inventory (EPSI) were used in this cross-sectional study. Participants also completed the Multidimensional Assessment of Interoceptive Awareness (MAIA) to measure interoceptive sensitivity and the suicidality subscale of the Depressive Symptoms Index (DSI) to evaluate suicidal cognitions. A mediation model was tested in MPlus to exam the relationship between these constructs with attitudes relating to social media consciousness as the predictor, interoceptive sensitivity as the mediator, and suicidal ideation as the outcome. Elevated attitudes relating to social media consciousness was indirectly associated with elevated suicidal ideation through lower interoceptive sensitivity. These findings underscore interoceptive sensitivity as a critical mechanism linking social media body consciousness to maladaptive outcomes such as suicidal ideation within individuals with disordered eating. Future research should explore longitudinal designs to establish causality.

Title: Validation of a photoelectric sensor system to detect oviposition timing in individually caged broiler breeder hens

Primary Author: Lauren Sroda

Additional Authors: Charlene Hanlon;Madison Berger;Carson Edge;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Understanding the time of oviposition in broiler breeders is an important metric to improve precision animal and feeding management in the United States. The objective of this project was to validate the use of a system using photoelectric sensors (PES) to quantify the time of oviposition of individually caged broiler breeders. The system was validated using 101 broiler breeder hens housed in individual cages within an environmentally controlled facility over a two-week period. The detection system consisted of a single PES and an opposing reflector installed on 3D printed dividers that separated the egg saver for each cage. The PES were measured with data logging systems using a one-minute sampling rate. Data analysis was performed in RStudio. A camera system and staff records were used to validate the PES system accuracy [94.7% (1,339/1,414)]. The PES were able to detect the egg within three minutes of the camera observation. Correctable errors, caused by cage design issues, could improve the accuracy of the system [98.7 % (1396/1414)]. Current limitations of the PES system are that sensors must be turned off during dark hours, double eggs could not be detected, and soft-shelled or cracked eggs could not be detected. Post-processing and determining the time of oviposition was much easier and quicker using a PES system (< 0.2 h) compared to a camera system (>100 h). The PES system costs approximately $284 per cage. This system provides an efficient and accurate means to explore feeding management and reproductive success of broiler breeders, leading to improvements in cumulative egg production, fertility, and hatchability.

Title: Validation of drug target genes in cancer cell lines using immunoblotting analysis

Primary Author: Lauren Woodyard

Additional Authors: Amit Mitra;Sarah Batten;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Prostate cancer (PCa) is one of the most prevalent cancers and the second leading cause of cancer death in United States men. The first-line chemotherapeutic treatment of PCa is androgen-deprivation therapy, which suppresses cancer progression initially. However, the majority of patients will progress to castration-resistant PCa (CRPC) within 2-3 years of treatment as androgen receptors undergo genetic modifications. Of these cases, the most aggressive and lethal PCa sub-type is metastatic castration-resistant PCa (mCRPC). The increasing incidence of this mCRPC, along with an increase in resistance to chemotherapeutic drugs, has led to a critical need to develop novel, more effective therapies. Clofazimine (CLF) is an FDA-approved drug for the treatment of leprosy. Our laboratory has previously shown the efficacy of CLF against the drug-resistant forms of chronic myeloid leukemia and multiple myeloma using in vitro, in vivo, and ex vivo modeling. We have also demonstrated the cytotoxic and apoptotic activity of CLF when given in combination with standard-of-care drugs for PCa. In this study, we validated the genes targeted by CLF in PCa cell lines using the immunoblotting or western blotting technique. As CLF has exhibited anti-proliferative effects in PCa, markers of apoptosis pathways were also investigated. Our results showed that CLF treatment resulted in higher expression of cell death and apoptosis-related proteins, as well as autophagy, indicating a potential mechanism of action. Next, we will validate the molecular targets of clofazimine using immunoblotting and functional assays.

Title: Roles and training of paraprofessionals for students with autism: Are schools complying with special education laws?

Primary Author: Leeann Wingard

Additional Authors:

Department/Program: Department of Curriculum and Teaching

College: College of Education

Abstract: Special education paraprofessionals work with the most vulnerable student population. However, they do not always receive the appropriate training to support students' needs effectively. Despite multiple federal legislations, school systems can fail to effectuate what federal laws stipulate. This problem has negatively impacted special education students who receive assistance from a paraprofessional. A possible cause of this issue could be administrators' lack of knowledge and understanding of special education laws and legislation that pertain to students with autism and the use of paraprofessionals to support them. A qualitative pilot survey will be developed to investigate the level of knowledge and understanding that school and special education administrators have regarding special education laws and legislation. The data from the survey will reveal administrators' knowledge of special education laws for paraprofessionals and students with ASD and whether there is a correlation between their knowledge, education, and experience. Administrators within school systems hold significant influence over personnel, including special education teachers and paraprofessionals. Therefore, fostering awareness of special education laws and legislation and addressing the specific needs of students with ASD in accordance with these laws is a crucial first step in ensuring that schools fulfill their legal obligations to support students with ASD.

Title: Enhancing preconception care awareness to improve maternal health outcomes in marginalized communities a focus on reducing health disparities

Primary Author: Leticia Raymundi Pinheiro

Additional Authors: Claire Thompson;Amy Pridemore;

Department/Program: Nursing

College: College of Nursing

Abstract: Despite a global decline in maternal mortality, the U.S. continues to see an increase, with Alabama's rate reaching 36.4 deaths per 100,000 in 2020—well above the national average of 23.8. Women from marginalized communities, particularly women of color and those in rural areas, face significant challenges such as limited healthcare access, provider shortages, and systemic racism, all of which contribute to worsening health disparities. Chronic conditions like obesity, hypertension, and diabetes often go undiagnosed before pregnancy, increasing the risk of complications. Improving maternal health requires a strong focus on preconception care to manage these conditions early. However, many marginalized women lack access to adequate care during this critical time, leading to poorer pregnancy outcomes. This project aims to increase awareness of preconception care among reproductive-aged women in marginalized communities. Data will be collected from participants through surveys assessing chronic conditions, physical activity, nutrition, substance use, and medication use. The results will help identify knowledge gaps, which will be addressed through group education and one-on-one interventions. Follow-up surveys will measure changes in knowledge and motivation to adopt healthier behaviors. By promoting healthier lifestyles and empowering women with essential information, this initiative seeks to improve maternal and infant health outcomes in Alabama.

Title: Calibration and performance evaluation of diverging diamond interchange traffic control management using drones

Primary Author: Li Quan

Additional Authors:

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: The Diverging Diamond Interchange (DDI) is an alternative interchange design that shifts cross-street traffic to the opposite side, improving traffic flow capacity and safety. Despite its advantages, the unique geometry and traffic flow patterns of DDIs present challenges related to driver behavior, speed management, and lane-changing dynamics. Evaluating the performance of a DDI during the planning and design stages often requires using traffic simulation software, such as VISSIM. However, parameters in VISSIM, including speed distributions, driving behaviors, lane-change distances, and the newly introduced curve speed function (VISSIM 2023), need to be calibrated to accurately reflect real-world conditions. This study developed and calibrated a VISSIM model for the first DDI in Mobile, Alabama, using data collected through drone videos, GPS devices, and the YOLOv8 AI model. The data included vehicle trajectories, speed measurements, and geometric features of the interchange, enabling a detailed simulation of traffic flow. A unique traffic control strategy implemented at this DDI involves the use of a "Stop on Red" sign for dual right-turn lanes at off-ramps. This requires vehicles to stop at the stop bar before deciding whether to turn on red, which contrasts with the traditional "No Turn on Red" rule. This approach aims to increase right-turn capacity and improve traffic flow efficiency. The research compared the operational effects of the "Stop on Red" and "No Turn on Red" strategies under varying traffic volumes, using metrics such as queue lengths and delays. Based on the findings, a general guideline was developed to help transportation agencies select the most effective traffic control strategy for DDIs based on specific traffic conditions.

Title: "Comparative Analysis of Machine Learning Models for E-commerce Purchase Prediction: A Value Range-Based Assessment of FM, XGBoost, and LightGBM

Primary Author: Libo Sun

Additional Authors: Peixiong He;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: The rise of Cost Per Purchase (CPP) advertising models necessitates accurate prediction of purchase behavior for effective risk management. This study evaluates three machine learning models—Factorization Machines (FM), XGBoost, and LightGBM—on a dataset of 142,483 e-commerce transactions, focusing on purchase volume and cost predictions. Our feature engineering pipeline processes heterogeneous data into 843 features, enabling comprehensive model comparison across different value ranges. XGBoost demonstrated superior purchase prediction performance (RMSE: 4.91, R^2: 0.62), while FM excelled in cost prediction (RMSE: 30.39, R^2: 0.61). Analysis revealed consistent model performance for low-value predictions but significant accuracy degradation in high-value segments, with error rates increasing up to 73.4% for purchases in the highest value range. We introduce a novel cluster-based correction mechanism that improves prediction accuracy for high-value transactions by 15.3%. Our findings provide practical guidelines for model selection in e-commerce advertising systems, emphasizing the importance of value-range-specific optimization strategies and suggesting a hybrid approach combining the strengths of multiple models for optimal performance.

Title: The functional role of dietary arginine on growth performance and gut health in starter pigs

Primary Author: Lillian Jeffers

Additional Authors: Marko Rudar;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Weaning is a critical period in pork production marked by stress and reduced feed intake, impacting gut health and overall performance. One stressor could be limited arginine availability in starter diets. Arginine is a key amino acid involved in weight gain and nitric oxide production, which plays an important role in immunity and vasodilation. Limited availability of arginine could affect gut structure and function. The objective of this study is to determine the impact of increasing the ratio of standardized ileal digestible (SID) Arg: Lys on starter pig growth performance. A total of 132 mixed-sex pigs (initial body weight = 8.61 ± 1.22 kg) were weaned at 28 days of age and assigned to one of four dietary treatments for 14 d (four pigs per pen): 1) ARG-75 (i.e., SID Arg: Lys, 0.75; n = 6); 2) ARG-90 (n = 8); 3) ARG-105 (n = 6); and 4) ARG-120 (n = 7). Body weight and feed intake were measured weekly; blood samples were collected on days 0, 7 and 14 to measure plasma amino acid concentrations. Average daily gain tended to increase linearly from ARG-75 (176 ± 43 g/d) to ARG-120 (211 ± 42 g/d; $P = 0.07$). Final body weight likewise increased linearly from ARG-75 (11.12 ± 0.55 kg) to ARG-120 (11.66 ± 0.54 kg; $P = 0.03$). Average daily feed intake and feed conversion ratio were not different among groups ($P > 0.10$). Plasma Arg concentration was not different among groups on day 0 or on day 7 ($P > 0.10$) but increased linearly from ARG-75 (46 ± 7 µmol/L) to ARG-120 (71 ± 6 µmol/L) on day 14 ($P = 0.01$). Plasma Lys concentration, while not different among groups on day 0 or on day 7 ($P > 0.10$), decreased linearly from ARG-75 (118 ± 22 µmol/L) to ARG-120 (40 ± 21 µmol/L) on day 14 ($P < 0.01$). The inverse relationship of plasma Arg and Lys concentration could be because both are absorbed by cationic transporters, such that increased dietary Arg reduced Lys absorption. Alternatively, increased ADG in pigs fed increasing amounts of Arg could drive Lys usage for weight gain.

Title: Enhancing access to hearing healthcare for Korean population by development and validation of the Korean version of the HEAR COMMAND Tool

Primary Author: Lily Dunaway

Additional Authors: JungMoon Hyun;Hae Sagong;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: This study describes the translation and validation process for the Korean version of the HEAR-COMMAND Tool, originally developed in English, to assess its cultural relevance and potential influence on individuals' likelihood to seek help for hearing concerns. Designed to support a shift from a biomedical to a biopsychosocial hearing healthcare model, the tool aligns with the ICF-Health Core Sets for Hearing Loss. It evaluates hearing, communication, and conversational disabilities, promoting comprehensive and person-centered care. The translation involved a rigorous process led by four Korean healthcare faculty members. First, two nursing department faculty translated the tool into Korean. A Korean-English language expert then reviewed the translation independently. Subsequently, a faculty member specializing in speech, language, and hearing sciences ensured the translation's cultural relevance and appropriateness. Validation was conducted by recruiting participants from a Korean online community in Lee County, AL. An information letter, feedback form, and the tool were emailed to participants. Version 1 was shared with 10 Korean-American adults fluent in Korean. Feedback identified several linguistic and structural issues, such as a lack of fluidity due to translation, and provided recommendations for simplifying terms and enhancing sentence clarity. Based on this feedback, Version 2 was developed and reviewed by an additional five Korean-American healthcare professionals. Their feedback on readability and fluency informed further refinements, resulting in the final Version 3. This version demonstrated improved readability and accessibility, with 14 out of 15 participants indicating that the tool would likely or definitely motivate them to seek help for hearing issues. The Korean HEAR-COMMAND Tool has the potential to improve access to hearing healthcare and encourage timely interventions within Korean-speaking communities. The translation and validation of the Korean version of the HEAR-COMMAND Tool highlights a critical issue faced by many Korean immigrants: language barriers in accessing healthcare, particularly in hearing care. Many Korean-speaking individuals in the United States may face difficulties in understanding English-language medical tools and health resources, which can discourage them from seeking timely help for hearing concerns. The development of culturally and linguistically appropriate tools, like the Korean version of the HEAR-COMMAND Tool, ensures that these individuals can better assess their hearing health in a way that is both understandable and relevant to their cultural context. For audiologists and healthcare professionals, this underscores the importance of integrating culturally competent, multilingual resources into clinical practice. By addressing language barriers, healthcare providers can reach underserved populations, enhance communication, and provide more effective, person-centered care, ultimately improving healthcare access and outcomes.

Title: Functional balance, movement profiles, and hearing outcomes in long-term hearing aid users as compared to non-hearing aid users with age-related hearing loss

Primary Author: Lilyann Mason

Additional Authors: Razan Al Fakir;

Department/Program: Communication Disorders

College: College of Liberal Arts

Abstract: Age-related hearing loss (ARHL) is a significant risk factor for falls due to its impact on increasing the cognitive load on balance and movement systems. While hearing aid use – a cornerstone in ARHL management – can help reduce cognitive load, numerous other factors also play a role in this complex interplay, such as multiple chronic health conditions and related medications. This study examines the functional balance and movement profiles of individuals with ARHL who have been using hearing aids for over two years. It further investigates how these profiles shape hearing-related outcomes, including perceived hearing disability and listening effort, as compared to non-hearing aid users. A cross-sectional study was conducted at the ABILITY Research Lab. Participants were recruited from the AU Speech and Hearing Clinic and classified into two groups: long-term hearing aid users and non-hearing aid users. Each participant completed a study protocol that included functional balance and movement outcome measures, patient-reported outcome measures, and an experimental protocol. The experimental component focused on internal and external conscious movement processing and included tasks designed to induce fall-related anxiety. Data collection is ongoing, and we anticipate the findings will provide critical insights into the role of hearing aid use in shaping functional and hearing-related outcomes. These insights aim to inform more holistic audiologic rehabilitation strategies to enhance overall health and reduce fall risk in individuals with ARHL.

Title: How Prepared Do First Generation College Students Feel Coming into College and How Can Colleges Help Them?

Primary Author: Lindsay Gardner

Additional Authors:

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Deciding to pursue a college education presents a daunting challenge, particularly for first-generation college students who lack the essential guidance that comes from having parents familiar with the college experience. Unlike their continuing-generation peers, these students often navigate their educational journeys without insights into the nuanced aspects of campus life, such as managing academic rigor, social integration, and logistical navigation, which are typically conveyed informally by experienced family members. This deficiency in support can lead to feelings of confusion and isolation, ultimately affecting their academic performance. Notably, the Education Advisory Board (EAB) reveals that 33% of first-generation college students discontinue their studies within the first three years, compared to only 14% of their continuing-generation counterparts, highlighting a pressing need for structured support. This study intends to survey first-generation undergraduate students regarding their preparedness for college, their assimilation into campus life, and their acquisition of crucial information related to navigating the university environment, major selection, and access to professional networks. We hypothesize that these students will report feeling less prepared and integrated than their peers and lag in their understanding of the implicit knowledge necessary for academic success. This research is significant as it addresses the persistent challenges associated with the hidden curriculum that first-generation students confront, aiming to inform institutions on how to enhance support mechanisms that facilitate student retention and success in higher education.

Title: Post-marketing safety of Lantus and its interchangeable biosimilar Semglee in the United States: A disproportionality analysis using FAERS database

Primary Author: Lotanna Ezeja

Additional Authors: Jingjing Qian;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: On July 28, 2021, Semglee (insulin glargine-yfgn) was approved by the U.S. FDA as the first interchangeable biosimilar to the reference product Lantus (insulin glargine) for treating diabetes mellitus. This cross-sectional study used the FDA Adverse Event Reporting System (FAERS) to examine adverse event (AE) reports and identify safety signals of Lantus and Semglee, within the U.S. from July 28, 2021, to September 30, 2024. We compared characteristics of age, sex, and type of reporter between Lantus and Semglee recipients (Chi-square test). The AE reports were organized into high-level group terms (HGLTs) using the Medical Dictionary for Regulatory Activities (MedDRA) hierarchy analysis. Disproportionality analysis, including reporting odds ratio (ROR) and empirical bayesian geometric mean (EBGM), was performed to detect safety signals for serious AEs, death, hospitalization, and top 6 HLGTs. A total of 19,009 and 1,412 AE reports were included for Lantus and Semglee, respectively. Semglee AE reports had a higher proportion of consumer reporters compared to Lantus ($P<.001$) but lower proportions of serious AE, death, and hospitalization than Lantus ($P< 0.001$). Lantus exhibited significant safety signals for device issues (ROR=1.3, 95% CI=1.2–1.4), medication errors and other product use errors and issues (ROR=2.8, 95% CI=2.7–2.9), and metabolic, nutritional, and blood gas investigations (ROR=11.7, 95% CI=11.2–12.2). Semglee had higher significant safety signals for device issues (ROR=118,7 95% CI=103.9–135.7) and medication errors and other product use errors and issues (ROR=3.4, 95% CI=3.0–3.8) but a lower safety signal for metabolic, nutritional, and blood gas investigations (ROR=3.0, 95% CI=2.3–3.9) than Lantus (Breslow-Day statistic, $P< 0.001$). EBGM results were consistent with the RORs. Our findings identified significant post-marketing reporting safety signals of Lantus and Semglee. Longitudinal studies are warranted to verify these detected safety signals.

Title: Understanding Athletes' Sense of Purpose and Mental Health Challenges

Primary Author: Lucero Montero

Additional Authors: Sara Driskell;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Fans believe that being an athlete is easy because they know how to handle pressure, have good communication, be in control of their emotions, and are expected to be friendly and approachable. In reality, athletes go through everyday emotions like everyone else. They have good days and bad days. Many great college athletes have lost their sense of purpose and meaning in their lives (e.g., Goraczko et al., 2021; Harris et al., 2019; Massey & Whitley, 2023; Seligman, 2011) due to injuries and losing passion in their sport, which has led to depression, stress, aggression, and frustration. For example, Naomi Osaka and Simone Biles publicly shared their depression stories within the last couple of years. Other athletes spend too much time worrying about how well they have performed. It leads them to lose passion for their sport, forgetting the real reason why they became athletes in the first place. This has caused them to have issues with their family and close relationships. In this research, I will create a survey to compare athlete's sense of purpose in their sport and outside of their sport as well as measure recent feelings of depression, stress, frustration, and aggression. This will include current athletes who know that they will continue their sport after college, athletes who will not play sports after college, injured athletes, non-injured athletes, and previous athletes that will be collected through snowball sampling. This research aims to uncover patterns that athletes follow after losing purpose in their sports and dealing with aggression and depression as well as helping them find a path forward after these challenges. We expect that many athletes will show these traditional patterns but that some will provide insight into more productive ways of healing and coping through a sense of purpose.

Title: Evaluating the Impact of Incentive Programs on Fresh Fruit and Vegetable Spending for Low-Income Households

Primary Author: Mackenzie Wood

Additional Authors: Alicia Powers;Joel Cuffey;Kara Newby;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Low-income individuals in Alabama spend less on fresh fruits and vegetables than the national average. Contributing factors to this matter include cost and limited access. Farmers markets could be a dependable source for fresh fruits and vegetables for Alabamians. This study examines the impact the Gus Schumacher Incentive Program (GusNIP) in Alabama that operates through the Supplemental Nutrition Assistance Program (SNAP). First, vendor names from participating farmers markets were harmonized from September 2021 to August 2024. Next, monthly reports from participating farmers markets were analyzed using Stata. Data analysis measure the change in the number of participating fruit and vegetable vendors, amount of GusNIP spending, SNAP spending, percent of SNAP spending, and percent of GusNIP spending over time. Preliminary results show that SNAP incentive programs can be important for increasing access to fresh fruits and vegetables at farmers markets. Findings from this study may be beneficial for evaluating efficacy and impact of this incentive program through SNAP. Figures and descriptive statistics summarize these changes over time. Analysis is ongoing, findings will be shared at the time of the presentation. Future research might investigate more sustainable models for implementing fruit and vegetable incentive programs through SNAP.

Dr. Anna Ehrhorn Title: Evaluating cell-free DNA as a potential biomarker for heifer fertility

Primary Author: Madalynn Welsh

Additional Authors: Wellison Jarles Da Silva Diniz;Paul Dyce;Priyanka Banerjee;Audrey Craner; Cody Brown

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Cow-calf production is a critical to the Southeast and U.S. economy, yet reproductive failure remains a major challenge, contributing to significant economic losses. Early prediction of reproductive potential could enhance beef production efficiency by reducing time and resources spent on unproductive heifers. Cell-free DNA (cfDNA) has been identified as a biomarker for unexplained infertility in humans, presenting an opportunity for application in livestock. We hypothesized that cfDNA concentrations increase in sub-fertile heifers at the time of artificial insemination (AI), serving as molecular signatures of fertility potential and pregnancy outcomes. Our objectives were two-fold: to examine differences in cfDNA concentrations in fresh vs. frozen plasma from beef steers and to compare cfDNA concentrations in heifers retrospectively classified as fertile or sub-fertile. For objective 1, blood was collected in duplicates from five steers at the Lambert-Powell Meat Lab, with plasma processed immediately or stored at −80°C for seven days. For objective 2, biobanked plasma samples from 72 Angus-Simmental crossbred heifers that underwent estrus synchronization, fixed-time artificial insemination (AI), and natural service was used. Pregnancy check was completed at day 90 post-AI. Plasma from samples collected at AI and pregnancy check were used to isolate cfDNA from six pregnant (fertile) and six non-pregnant (sub-fertile) heifers at two time points. cfDNA was extracted according to the Zymo's Quick-cfDNA™ Serum & Plasma Kit protocol and quantified using dsDNA HS assay kit. Paired t-tests revealed significantly lower cfDNA concentrations in fresh vs. frozen plasma ($P = 0.002$) in steers. Two-way ANOVA showed no significant differences in cfDNA between fertility groups or time points. High sample variability and weak correlation between time points observed here contrast with human studies, highlighting the need for larger sample sizes and improved methods to reduce variability. These findings suggest that while cfDNA holds promise as a potential biomarker in cattle, further studies are necessary to refine methodologies and validate its predictive potential in reproductive management.

Title: Enhanced Pathogenicity of Vibrio species due to Type VI secretion systems during infection of sea urchin larvae

Primary Author: Madeline Hamborg

Additional Authors: Jake Tatum;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Vibrio species are a diverse group of gram-negative, facultatively anaerobic bacteria that is present in sea water and the cause of many different pathologies in marine invertebrates. Specifically, the pathogenic species V. diazotrophicus and V. paucivorans elicit strong immune responses in adult and larval purple sea urchins (Strongylocentrotus purpuratus). Sea urchins provide a unique model system in which to study immune responses. As invertebrate deuterostomes, sea urchins share important genetic similarities with vertebrates but are morphologically simple and transparent. T6SS are transmembrane "syringes" that "inject" effector molecules (such as toxins) into host cells. Hemolysin-coregulated protein (Hcp) is the structural subunit of the molecular needle and therefore a major excreted protein essential for function. Our previous analyses have demonstrated that the Type VI secretion system of V. diazotrophicus has an additive effect on pathogenicity. The larval immune response relies on complex networks of pattern recognition receptors (e.g. Toll-like receptors [TLRs] and Nod-like receptors [NLRs]) that detect microbes and activate immune responses. In larvae this response is characterized by immune cell migration and rapid production of cytokine IL-17. Exposure to V. diazotrophicus and V. paucivorans elicits a robust, non-lethal immune response however V. paucivorans employs a much more transcriptionally active Type VI secretion system. We hypothesize that the contributions of the Type VI secretion system of V. paucivorans to pathogenicity in sea urchin larvae is, in part higher than its contributions within V. diazotrophicus. To characterize the importance of this complex in larval pathogenicity, we have developed and implemented suite of novel genetic tools previously tested within V. diazotrophicus to eliminate three separate hcp encoding regions within V. paucivorans. In this method, RecA-mediated homologous recombination targets selection markers to the gene of interest with vectors containing gene-specific sequences. This work represents the first investigation of specific mediators of bacterial pathogenicity in echinoderms. In a broader sense these findings will help elucidate specific contribution of specialized secretion systems to pathogenicity and the generated mutants can but used to study pathogenicity in other echinoderms

Title: Pediatric type one diabetes management across the lifespan

Primary Author: Madison Beavers

Additional Authors: Christine Feeley;

Department/Program: Nursing

College: College of Nursing

Abstract: Pediatric Diabetes effects approximately 352,000 children under the age of 20 in the United States. Of these children, 304,000 have been diagnosed with Type One Diabetes Mellitus (T1D). T1D is a chronic, autoimmune, metabolic condition in which the body is insulin deficient and prone to hyperglycemia. Being diagnosed with a lifelong condition at such a young age has an impact on both long-term physical wellness and mental wellness. Children diagnosed with T1D, specifically adolescents, are at a higher risk for depression, anxiety, and eating disorders. Research shows that 30-40% of individuals diagnosed with T1D developed kidney failure in their lifetime. Blood glucose management is the best way to combat these comorbidities and increase positive outcomes. The purpose of this study is to identify the most common mediums children diagnosed with T1D and their families used to manage their blood glucose levels. We looked at the use of insulin pumps, continuous glucose monitors, assessed the child's comfortability with leading their own blood glucose management, and determined if parents and kids had similar views on how management was going. We created a cross-sectional survey for participants to fill out regarding their T1D management. The survey was 10 questions and was taken through Qualtrics. The same survey was given to both the child with T1D and their primary caregivers. The purpose of having them both fill out the same survey was to cross-analyze their thoughts on how successful their T1D management was. We are working in collaboration with Camp Seale Harris, a pediatric diabetes camp, to publish our survey on their website and E-Newsletter. We are currently in active data collection. In the future, we would like to take the data collected and determine which practices are most helpful and how they can be implemented to aid in long-term health and prevent comorbidities such as kidney failure.

Title: The Smile Bright initiative: Empowering rural communities through oral health education

Primary Author: Madison Contrucci

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Access to oral health care remains a significant challenge in underserved Hispanic communities, where language barriers, financial constraints, and limited health literacy often exacerbate disparities. To address this critical need, the Smile Bright initiative was developed and led by a Pre-Dental, Honors college student to promote oral health education and access to preventive care within this vulnerable population. This initiative involved a multifaceted approach, including a partnership with a local dentist, culturally tailored education sessions, distribution of bilingual oral health resources, and collaborations with local providers to facilitate future dental services. This project emphasized engaging families through interactive activities that taught proper oral hygiene techniques, the importance of regular dental check-ups, and the connection between oral health and overall well-being (Oral Health in Alabama). Smile Bright reached over 100 participants, providing education and distributing essential oral care products such as toothbrushes and toothpaste. Participant feedback highlighted increased awareness and willingness to adopt better oral health practices. Based on survey results, a common behavioral theme emerged: many children in the community consume milk or juice before bedtime, which leads to negative oral health outcomes. In response, the initiative encouraged water as the most oral-friendly beverage and taught children proper brushing techniques. The Smile Bright Initiative highlights the impact of student-led efforts in addressing health disparities through culturally sensitive and community-centered approaches. This model offers a replicable framework for improving oral health equity in other underserved populations, fostering healthier communities through education, prevention, and access to care. The initiative plans to continue expanding its reach and services to further support these communities.

Title: Inter-organizational networks among food banks: Impact on food aid distribution and resource sharing

Primary Author: Madison Edwards

Additional Authors: LaDonna Thornton;

Department/Program: Supply Chain Management

College: Harbert College of Business

Abstract: Food banks are vital in helping fight food insecurity, but they often face challenges in providing high-quality food due to limited resources, fluctuating demand, and logistical issues. Thornton et al. (2024) highlight these struggles, especially the difficulty sourcing diverse and nutritious food. This study aims to fill a gap by exploring how small food banks can improve food aid delivery by working together through inter-organizational networks. While most research focuses on the operations of individual food banks, less attention is given to the benefits of collaboration between organizations. By comparing food banks participating in these networks and interviewing managers and network coordinators, this research will explore how these partnerships help food banks meet community needs. It also explores how food banks improve food quality, and operate more efficiently. The goal is understanding how these networks can lead to higher service quality and greater community satisfaction. Ultimately, this study could provide valuable insights to improve food aid systems, guide policy changes, and spark future research. The goal is to help build a more effective and responsive approach to tackling food insecurity.

Title: The impact of animal-assisted therapy on stress levels in Auburn University students

Primary Author: Madison Goehle

Additional Authors:

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Academic and social pressures combined with new routines can increase stress levels in university students, impacting their academic performance as well as their physical and emotional well-being. Animal-assisted therapy is a form of therapeutic intervention utilizing trained therapy animals to improve health. This form of therapy may help reduce pain, improve coping skills, and lessen feelings of anxiety and fatigue. This study evaluates the impact of therapy dog Sully on the self-reported stress levels of Auburn University students over a semester. Participants were recruited through class and email announcements. Students were surveyed pre- and post- interactions utilizing the validated tool titled Cognitive Test Anxiety Scale – 2nd Edition which is a 24 question Likert-scale measuring student anxiety. The post-interaction survey included additional opportunities for students to provide qualitative responses about their experiences interacting with Sully. Survey results suggest that therapy dog interaction lowered scored levels of cognitive test anxiety in participants. Participant feedback points to a consensus that therapy dog interaction provided an immediate mood boost, helping participants feel more relaxed and uplifted, however, it was acknowledged that the infrequent interaction patterns limited effectiveness of this therapy. Some participants felt that positive results were short-lived, while others did not interact with the dog regularly enough to see long-term effects. This study's limitations include the irregularity of therapy dog interactions, which may have impacted the ability to assess long-term effects on anxiety. Additionally, the sample lacked diversity. Most participants were Caucasian and from Auburn University, thus limiting the generalizability of findings. Future research should explore more frequent and structured interactions and a broader participant pool to better understand lasting impacts and individual preferences in relation to stress reduction with animal-assisted therapy.

Title: A cross-sectional survey assessing law enforcement and healthcare provider perceptions and preferences surrounding an opioid sensor device

Primary Author: Madison Holland

Additional Authors: Lindsey Hohmann;Shannon Woods;Bryson Grimsley;Olivia Radzinski;

Department/Program: Phamacy

College: Harrison College of Pharmacy

Abstract: Opioid misuse and overdose remain a concern in the U.S., making identification of strategies and tools to minimize opioid-related harms critical. Therefore, the purpose of this study was to understand law enforcement and healthcare provider perceptions and preferences about the design and function of a potential new opioid sensor device. A cross-sectional survey study was conducted including adults ≥18 working in Alabama, and employed in law enforcement, social work, or healthcare. Perceived importance of sensor design elements was measured using a 7-point Likert-type scale, while utilization and function preferences were measured via multiple-choice. Measures were characterized using descriptive statistics. There were 147 respondents, including pharmacists, nurses, physicians, behavioral health, social work, and law enforcement. 13.8% of respondents were aware that opioid sensor devices are on the market, and only 2.1% had ever utilized a device. Availability in hospital emergency departments was the highest rated item with a mean (SD) score of 6.66(0.80). Sensitivity and specificity of the test (6.42[0.98]), rapid detection time (6.42[0.88]), ability to detect opioids in a broad range of substance (6.42[0.93]), availability in law enforcement offices (6.33[1.08]), ability to detect multiple types of opioids (6.29[1.12]), and portability (6.20[0.96]) were also highly rated. A 2- to 5-minute detection time was rated as reasonable by 32.6% of respondents, with 53.0% preferring to pay <$15 per test. In conclusion, awareness of opioid sensor devices was low. Newly developed opioid sensor devices should consider prioritizing accessibility in emergency departments and law enforcement offices, ability to detect a broad range of opioids, detection time of 2-5 minutes, and cost less than $15 per test. Future studies may assess differences in device preferences, perceptions, and intentions across professions.

Title: Effect of ryegrass variety on digestibility and methane production potential

Primary Author: Madison Kinard

Additional Authors:

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Livestock has been linked to large amounts of greenhouse gas emissions that have become a major concern for America's ever-growing livestock production industries. Enteric fermentation of grazing livestock species is responsible for 27% of all CH4 emissions in the United States. This alarming percentage has stimulated research on CH4 mitigation strategies, especially through nutritional manipulation. Factors such as forage quality and type can influence enteric CH4 production, leading to innovative approaches to close the gap in nutritional management research. Thus, the research objective was to determine the influence of forage variety on methane production potential and in vitro dry matter digestibility. This experiment was conducted as a randomized complete block design with four blocks of 44 ryegrass cultivars. Samples were subjected to an in vitro incubation procedure to assess methane production potential. Our hypothesis is that there will be an influence of forage variety on methane production potential. We expect this research to become the normal practice in helping livestock production systems find a more efficient nutritional management scheme. In the future, this research will form the basis for less energy intensive livestock feeding systems.

Title: Development of the Medication Education for Dementia Support (MEDS) Toolkit for community pharmacy collaboration with home health

Primary Author: Madison Wright

Additional Authors: Natalie Hohmann;Amber Hutchison;Heqin Yang;Shane Enriquez;

Department/Program: Clinical Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Homebound older adults with dementia have multiple medications that are difficult for family caregivers to manage. This study investigated feasibility of using the MEDS Toolkit for community pharmacist collaboration with aging services and home health agencies in Alabama to provide medication therapy management (MTM) services for homebound older adults with dementia. A total of 18 panelists participated in 3 surveys to gather feedback on the toolkit's content, format, and design. Eligible panelists were community pharmacists, home health employees, or aging services employees in the South. In the final survey, 92% were satisfied/extremely satisfied with its content, 85% satisfied/extremely satisfied with its format, and 92% satisfied/extremely satisfied with its design. Most panelists thought the toolkit was feasible, acceptable, and appropriate to use as a resource when initiating a community pharmacist-led medication management service for homebound older adults with dementia. Regarding feasibility, 92% of panelists in the final survey agreed/completely agreed it was implementable and 100% that it seemed easy to use. Regarding appropriateness, 92% agreed/completely agreed it seemed like a good match and 100% that it seemed applicable. Likewise, regarding acceptability, 100% agreed/completely agreed it met their approval and appealed to them. However, some participants mentioned the toolkit was too long and that service reimbursement may be challenging to implement. After incorporating panelist feedback, the final MEDS Toolkit contains 10 key sections: 1) Provider Resources; 2) Home and Community Services; 3) Patient and Caregiver Education; 4) Practice Tips; 5) MEDS Service Flier; 6) Decision Support Tool; 7) Medication Risk Assessment; 8) Forms and Templates; 9) MEDS Action Plan; and 10) Reimbursement Model. Additional research is needed to implement pharmacy-led MTM services for homebound older adults with dementia, using the toolkit as a guide.

Title: Gene flow risks and its possible containment strategies in self-pollinated weed species for herbicide resistance spread

Primary Author: Mahboobeh Mollaee

Additional Authors: Aniruddha Maity;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The spread of herbicide resistance in weed species is a growing challenge in agricultural systems, and gene flow can contribute to the dissemination of herbicide resistance alleles. While extensive research has focused on cross-pollinated weeds, less is known about gene flow in self-pollinated species. This study reviews the extent of gene flow in herbicide resistant and susceptible biotypes in self-pollinated weeds examining its contribution to resistance spread. A comprehensive literature review was conducted, to assess gene flow patterns, dispersal mechanisms, and influencing factors. Statistical analyses system (SAS) were performed to evaluate correlations between gene flow distances and environmental variables such as temperature, precipitation, humidity, and elevation. Results indicate that there is a significant variation in gene flow range among the species and families. Self- pollinated weed in Asteraceae family show the highest gene flow percentages by 12%. The second and third families with the highest gene flow percentages were Chenopodiaceae and Malvaceae, at 9.9 and 8.4%, respectively. In contrast, the lowest values were observed in Lamiaceae and Fabaceae families, with gene flow percentages of 0.0066% and 0.22%, respectively. Furthermore, the evaluation of environmental factors effects showed that relative humidity has a significant relation with gene flow percentage at the 0.05 level ($P<0.05$). This suggests that biological and ecological factors can play a significant role on the extend of gene flow. Understanding gene flow in self-pollinated weeds is essential for developing effective strategies to mitigate the spread of herbicide resistance and improve sustainable weed management practices. Based on the literature review and consist with our data, different agricultural activity can also affect herbicide resistance frequently by changing the environmental factors like soil moisture. Therefore, various containment strategies, such as integrated weed management and agronomic practices, are suggested to minimize gene flow and its consequences.

Title: The cytokinin type; cis-Zeatin delays leaf senescence in tomato under salt stress

Primary Author: Malsha Thejani T Wasala Mudiyanselage

Additional Authors: Risheek Rahul Khanna;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The plant hormone cytokinin (CK) plays a key role in responding to different abiotic stressors including salinity to delay leaf senescence. cis-Zeatin (cZ) is a naturally occurring CK, which is less studied than its well-known isoform trans-Zeatin (tZ). Here, we investigate cZ to determine its functional role in regulating leaf senescence under salt stress in Solanum lycopersicum (Tomato). Mature tomato leaves treated with cZ or tZ were examined at early (2h) and late (72h) time points after exposure to 150mM NaCl then parallel physiological and transcriptomic analyses were performed. Physiological analysis of PSII efficiency (Fv/Fm) and chlorophyll content revealed that salt accelerates leaf senescence, which can be delayed by both cZ and tZ in a dark induced leaf senescence bioassay. Transcriptomic (RNAseq) analysis indicates increasing numbers of Differential Expressed Genes (DEGs) from early to late leaf senescence under salt stress. cZ treatment uniquely regulated genes +/- salt, with the most DEGs identified at 72h and indicates that cZ affects multiple signaling pathways and regulatory networks involved in salt stress including photosynthetic, hormone signaling. Although most CK regulations overlapped in direction/response, interestingly some antagonistic gene regulation was also found. Overall, this shows that the CK cZ is involved in delaying leaf senescence under salt stress.

Title: Growth dynamics of Xylella fastidiosa almond strains in grapevine xylem sap

Primary Author: Mamata K C

Additional Authors: Leonardo De La Fuente;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Xylella fastidiosa (Xf), a xylem-limited plant pathogen, causes devastating diseases like Pierce's disease (PD) in grapevines and Almond leaf scorch disease (ALSD), among others. Some PD Xf strains can also cause ALSD and vice versa. Since xylem sap is the sole growth medium for Xf in plants, we hypothesize that strain-specific growth in xylem sap determines colonization and virulence in different hosts. In this study, we compared in vitro growth phenotypes and biofilm production by different Xf strains isolated from almonds across different media, comprising artificial media (PD3) amended with 25%, 50%, and 75% grapevine sap collected from Vitis vinifera 'Chardonnay' grown in the field. Strains showed variations in biofilm formation, with some producing more biofilm at higher sap concentrations, while others showed reduced biofilm formation. These preliminary in vitro results support the hypothesis that the biofilm formation in xylem sap could be predictive of symptoms in planta, based on a limited number of studies where virulence in planta was tested for some strains. Currently, more extensive virulence testing is being performed in the greenhouse to validate the results across multiple strains. Ongoing research also includes testing the strains in microfluidic chambers, used as 'artificial xylem vessels', containing xylem sap from grapes and almonds. Our study will help assess the potential virulence of certain Xf strains based on xylem sap grown in vitro.

Title: Equine proximal sesamoid bone development

Primary Author: Mana Okudaira

Additional Authors:

Department/Program: Clinical Sciences

College: College of Veterinary Medicine

Abstract: Despite the pathology commonly observed in equine proximal sesamoid bones (PSBs), including sesamoiditis and fracture, the development and maturation of these bones is still poorly understood. The objective of this study was to describe the process and pattern of endochondral ossification in PSBs obtained from fetuses and young horses using micro-CT and histology. Proximal sesamoid bones from 12 horses, ranging in age from a 105-day old fetus to a 540-day old yearling were collected. Mid-sagittal histologic sections of PSBs were stained with hematoxylin and eosin and safranin O/fast green and examined to describe the cartilage anlagen, ossification center, spherical growth plate activity, articular cartilage, and entheses formation. For samples with adequate mineralization, micro-CT analysis was performed to characterize tissue volume (TV), bone volume fraction (BV/TV), height, width, depth, trabecular thickness (Tb.Th), and anisotropy. The study demonstrated that equine PSBs mineralize by endochondral ossification during the late gestation to early post-natal period. The spherical growth plate activity was variable across apical, flexor, basilar, and articular ossification fronts. Structural organization of the articular cartilage and fibrocartilaginous entheses occurred after cessation of growth activity of the spherical growth plate. The fibrocartilaginous entheses of the flexor cortex of the PSB was not mature at 540-days post-gestation. The delayed maturation of the fibrocartilaginous entheses and articular cartilage may play a role in the pathophysiology of equine PSB pathology and warrant further investigation.

Title: Assessing Impacts of Particulate Matter PM2.5 Emission Regulatory Changes in Forest Industries and Landowners in Alabama, USA

Primary Author: Manisha Subedi

Additional Authors:

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Alabama, renowned for its extensive forest areas and leading forest industries, significantly contributes to the nation's economy, ranking first in loblolly pine stock volume, second in pulp and paper production, and sixth in lumber and panel industries. The recently revised primary annual fine particulate matter (PM2.5) standard from 12.0 $\mu g/m^3$ to 9.0 $\mu g/m^3$ by the U.S. Environmental Protection Agency (EPA) is expected to present challenges for Alabama's forest industries, particularly in rural areas. This study aims to understand perceptions and investigate the economic, environmental, and operational impacts of the revised PM2.5 regulations on sawmills, pulp and paper industries, and forest landowners in Alabama. Primary data collection will involve focus group discussions with industry and policymaker representatives, and surveys with industry people and landowners to gather data on their perceptions, impacts, and adaptive strategies. Stratified and random sampling methods will be applied to select primary industries from the online-based AFC Industry Directory in Alabama. PM2.5 emissions will be collected using portable air quality monitors via drone flyovers before, during, and after prescribed burns. The data will be analyzed using MAXQDA and R software while emission hotspot mapping will be performed using Arc GIS Pro. Secondary data will be extracted through government documents, reports, and journals to support the primary data. Funded by the USDA-NIFA, this research spans two years and the results will be disseminated through reports, presentations, thesis, and peer-reviewed publications. The findings will support informed decision-making and strategies for balancing regulatory policies with practical implications for Alabama's forest industry, ultimately fostering a healthier population, a resilient environment, and a thriving economy in rural communities.

Title: The Effects of Innings on Rotational Velocities in Collegiate Baseball Pitchers

Primary Author: Margaret Green

Additional Authors: Gretchen Oliver;Adam Nebel;Benjamin Lerch;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Fastball velocity is essential to performance in baseball pitching and influenced by optimizing the rotational velocities of the pelvis, trunk, and shoulder. However, there is limited evidence regarding how fatigue, particularly in a game, may influence these rotational velocities. Therefore, the purpose of this study was to examine the impact of innings pitched on rotational velocities in collegiate baseball pitchers by analyzing the rotational velocities of a pitcher's first and last five fastballs during a game appearance. Biomechanics data from 83 collegiate (57.7±12.5 kg, 165.0±12.1 cm) baseball pitchers who threw a minimum of 40 pitches in a single game were utilized for analysis. Peak rotational velocities of the pelvis, trunk, and shoulder for the first and last five fastballs thrown in a game were collected using an 8-camera markerless motion capture system (KinaTrax, Boca Raton, FL). A TrackMan Stadium V3 unit recorded pitch velocities. Paired samples t-tests, with an adjusted alpha level of 0.01, were used to determine if there are within-subject differences in rotational velocities, or pitch velocity, between the first and last 5 fastballs thrown during a game. Paired samples t-tests revealed no difference in fastball velocity (90.5±2.9 vs 90.9±3.0 mph, $t_{82}=2.28$, $p=.025$), peak pelvis rotational velocity (612±87 vs 616±82 deg/sec, $t_{82}=0.82$, $p=.41$), peak trunk rotational velocity (1105±83 vs 1109±79 deg/sec, $t_{82}=0.92$, $p=.36$), or peak shoulder rotational velocity (4490±530 vs 4436±550 deg/sec, $t_{82}=1.37$, $p=.18$) between the first and last 5 fastballs thrown in a single outing by a collegiate baseball pitcher. These results suggest that the number of innings pitched does not impact peak rotational velocities; therefore, the influence of fatigue may manifest in other performance aspects, such as pitch accuracy. Future research should investigate additional variables to elucidate further the biomechanical changes associated with fatigue in baseball pitchers.

Title: Out of the Dark: Empowering Religious Parents to Address Teen Pornography

Primary Author: Margaret Mixon

Additional Authors:

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Previous research has established that viewing pornography during adolescence is often correlated with negative health outcomes and risky behaviors. Parents across all contexts, and especially within religious circles, want to help their child develop a healthy attitude toward pornography but often lack the tools and education necessary to do so. This project seeks to establish some evidence-based techniques for addressing pornography usage among religious families. The study first evaluated prior research on the impact of sexually explicit materials upon the adolescent brain structure. The study found that viewing pornographic material can change the way that a brain develops and therefore argues that early action against pornography is necessary for proper development (Brown & Wisco, 2019). The study then used research and theoretical models such as the Shame Resilience Theory and The Grubbs Model of Moral Incongruency to explain prevention, education, and intervention techniques with the intent to educate parents on how to foster positive relationships with teens and encourage healthy attitudes towards pornography without creating shame experiences. A public service announcement (PSA) informational video was then developed to disseminate these findings to parents from religious contexts.

Title: Characterization of the transient perinatal rise in luteinizing hormone in cats and dogs

Primary Author: Margaret Schuler

Additional Authors: Douglas Martin;Aime Johnson;Johanna Ehrhardt;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 resulting in production and release of the 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. Activation of the HPG axis occurs both in fetal life during the second trimester and postnatally, beginning at 2 weeks in humans, during an event termed minipuberty, referred to here as transient perinatal HPG activation. This hormonal event is both important and necessary for priming of 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, and normal cognitive function later in life. However, this period has only been partially characterized in a few mammalian species. Therefore, given the broad importance and impact of minipuberty, we characterize hormonal changes during minipuberty in two important companion species, cats and dogs. To our knowledge, this is the first characterization of this hormonal event in these important translational research models. Here we find transient alterations in LH levels in dogs beginning around 3 weeks of age that subside by 3 months of age. In contrast, cats have transient LH peaks that are both higher and earlier beginning one week after birth but wane by 2 months of age.

Title: Protein Spam Filter: A Machine Learning Tool for Predicting Structural Viability of Newly-Designed Proteins in the EASME Toolkit

Primary Author: Maria Victoria Liendro

Additional Authors: James Browning;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Proteins are sequences of amino acids that have evolved to carry out diverse functions. For example, proteins can make crops more resistant to pests, enhance biofuels production, or aid in developing targeted drugs. Designing custom proteins for specific applications is promising but challenging: with 20 amino acids and sequences often exceeding 1,000 residues, the possible combinations are countless, but only a fraction are viable, resulting in the vast majority of time being spent on evaluating unviable solutions. To address this, we developed the ``Protein Spam Filter'', integrated into the Evolutionary Algorithms for Simulating Molecular Evolution (EASME) toolkit, to predict whether a new protein is structurally functional, enhancing the efficiency of automated protein design. The Protein Spam Filter comprises two key components: (1) the `correctness' module, which distinguishes real proteins from non-functional sequences using an evolved neural network trained on the UniProt database (~58,000 real proteins), and thousands of artificially created `bad' sequences (including random, reversed, and highly mutated sequences), achieving over 95% accuracy; and (2) the `aggregation' module, which predicts protein aggregation propensity -— a phenomenon linked to diseases such as Alzheimer’s and type 2 diabetes, as well as pharmaceutical product quality and functionality. This module was trained on the A3D-MODB database (~500,000 predictions across 11 model species) and achieved up to 86% accuracy. Together, these components help ensure that newly-designed proteins are structurally stable and viable, fostering progress in protein customization with applications in biotechnology and medicine.

Title: Avian Influenza Viruses H9Nx and H4Nx: Growth Dynamics in Avian Cell Lines

Primary Author: Mariana Andrioli Pinheiro

Additional Authors: James Krehling;Diego Ernesto Ventura Urbina;Rocio Gerez Miranda;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Avian influenza virus (AIV) poses a risk to wildlife, poultry, and global food security. Low pathogenic AIVs (LPAIVs) have been identified in various bird species, predominantly circulating in waterfowl. Their adaptability and potential for cross-species transmission highlight the need for further research on the mechanisms driving inter-species transmission. This study evaluated the susceptibility and replication dynamics of H9Nx and H4Nx AIV strains in different avian cell lines. The H9 subtypes investigated were isolated from turkey (H9TK), chicken (H9CK), wood duck (H9WD), and ruddy turnstone (H9RT), while the H4 subtypes were derived from blue-winged teal (H4BWT), turkey (H4TK), and mallard (H4ML). Viral replication was assessed in chicken (DF-1), quail (QM5), and duck cell lines, with MDCK as a control. The AIV strains were inoculated at MOI of 1, and viral titers were measured by real-time RT-PCR at 24, 48, 72, 96, and 120 hours post-inoculation (hpi). All tested cell lines were susceptible to H9Nx and H4Nx infections. Among the H4 strains, only H4BWT and H4ML exhibited significantly higher replication. H4BWT displayed the highest viral titers across all cell lines, surpassing those of the H9 strains, with peak values of 7.84 Log10/ml in DF-1, 8.32 Log10/ml in duck cells, and 8.03 Log10/ml in QM5. In DF-1 cells, H4BWT (5.21–6.83 Log10/ml) and H9CK (5.83–6.73 Log10/ml) had the highest titers, whereas H9TK showed a delayed increase in viral load. In duck cells, H4BWT and H4ML demonstrated high replication compared to H9 strains, following a similar replication pattern. In QM5 cells, the H4 AIV had high titers, while these cells showed low permissiveness to H9 AIV, with low titers for H9CK and H9TK. These findings highlight the differences in AIV replication across various cell lines and viral strains. Further research is required to determine the molecular mechanisms influencing viral replication and host susceptibility of LPAIV in avian species.

Title: Post-Traumatic Stress Disorder and Self-Injurious Thoughts and Behaviors: Exploratory Network Analysis and Network Comparison Test in Two Trauma-Exposed Community Samples

Primary Author: Marielle Gomez

Additional Authors: Tracy Witte;Frank Weathers;Brianna Jackson;Abigail Camden;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Suicide is a serious public health issue. Preexisting psychopathology, such as posttraumatic stress disorder (PTSD), has been established as a risk factor for suicidal thoughts and engaging in self-injurious and suicidal behavior. While PTSD has been consistently linked to increased risk for self-injurious thoughts and behaviors (i.e., SITBs), traditional statistical methods may be too limited to capture the complexities of both PTSD and SITBs and the mechanisms that connect and maintain their comorbidity. Network analysis is a statistical method that can better model the complexities of PTSD and SITBs and help identify how the two are connected. Several exploratory networks on PTSD and SITBs have been estimated; however, to date, replication of these exploratory network structures has not been conducted. Thus, in the current study, we estimated an exploratory network of PTSD symptoms and SITBs in a trauma-exposed community sample (N=893) to determine which symptoms of PTSD and SITBs "bridge" the two psychological phenomena using measures of bridge centrality. Then, the replicability of findings from the exploratory network was assessed by employing a network comparison test (i.e., statistical measures of invariance between two network models) with a second community sample of trauma-exposed participants (N=367). The PTSD symptoms of engaging in reckless or self-destructive behavior and having negative beliefs about the self, world, and others and the SITB symptom of suicidal ideation emerged as having among the highest bridge centrality measures across both samples. Further, all measures of network invariance were not significant, indicating replicability of results. By furthering our understanding of how PTSD and SITBs are linked, our study findings help to identify the key symptoms that maintain PTSD and SITBs to target with interventions and reduce the risk of death by suicide.

Title: Perception and sense of agency in skilled nursing homes

Primary Author: Marina Bossle

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: More people are living longer, driving the need for more assisted living and skilled nursing homes. There is a concerning lack of focus on comfort and a sense of agency in skilled nursing homes. Interior design plays a crucial role in improving the quality of life in these environments by fostering a sense of agency—defined as the experience of control linked to specific actions. Agency, which is often inaccurately conflated with independence, significantly impacts a person's well-being, and is a key measure of overall quality of life. This makes it essential to design spaces that empower residents to feel a sense of agency even though they live in a facility where much of their independence is curtailed. This research uses evidence-based design to generate a design solution for a prototypical day room in a skilled nursing home. The proposed approach creates a hospitable and inviting space by incorporating flexible furniture that supports diverse activities. Additionally, integrating automated doors, adjustable lighting, temperature control, mechanized window coverings, and thoughtfully selected materials and colors enhance usability and comfort. Prioritizing connections to nature and fostering opportunities for social engagement are also critical considerations for designing for agency, especially when designing for a population that may have mobility challenges. Ultimately, this study aims to identify design solutions that enhance skilled nursing home residents' well-being, promoting a higher quality of life.

Title: Using Mutations in a Dimerization Interface of ERBB4 and ERBB2 to Elucidate the Role of ERBB4-ERBB2 Heterodimers in BRAF-WT Melanomas

Primary Author: Markelle Scott

Additional Authors: David Riese;Haram Kim;Nick DeFeo;Tori Huffman;Ella Wilson;Teigen Nelson;

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. The proliferation of four BRAF-WT melanoma cell lines are driven by elevated transcription of wild-type ERBB4 or gain-of-function mutant alleles of ERBB4. ERBB4 encodes a receptor tyrosine kinase that is closely related to the Epidermal Growth Factor Receptor (EGFR), ERBB2 (HER2), or ERBB3 (HER3). Moreover, three of these ERBB4-dependent, BRAF WT melanoma cell lines are simultaneously dependent on ERBB2. Previous data suggest 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 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: TIKI1/2 is required for anterior-posterior axis specification and patterning in sea urchin embryos.

Primary Author: Mary Seymore

Additional Authors: Che Ka;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Three different, yet interconnected Wnt pathways govern anterior/posterior (A/P) axis specification and patterning during early sea urchin embryogenesis. Previous studies suggest that secreted and membrane-bound modulators play critical roles in regulating embryonic Wnt signaling in multiple organisms. Specifically, in vertebrates, novel, Wnt-specific metalloproteases known as TIKI1 and TIKI2 was shown to regulate A/P axis patterning. In this study, we describe how the sea urchin orthologue TIKI1/2 is integrated into the A/P Wnt signaling network in sea urchin embryos. Expression analyses indicate that maternal-and-later-zygotically expressed tiki1/2 transcripts are distributed broadly during cleavage stages and then dynamically expressed throughout the rest of embryogenesis. Interestingly, tiki1/2 is co-expressed with specific Wnt-signaling components including fzd5/8, sfrp1/5-like, sfrp1/5-like, sfrp3/4, dkk3 and wif1, forming a complex, Wnt-signaling modulation environment that precisely governs the position of the anterior neuroectoderm (ANE) along the A/P axis. Functional perturbations using Morpholino antisense oligonucleotides, overexpression, and epistasis experiments demonstrate that TIKI1/2 is critical for patterning of the embryo along the A/P axis. TIKI1/2 morphants exhibited a radialized, exogastrulated phenotype that failed to form a skeleton. To better understand how TIKI1/2 is affecting specific GRNs along the A/P axis, we accessed the expression of key factors using whole-mount in situ hybridization. We found that disturbing TIKI1/2 function resulted in sever miss-expression of GRN factors, including cardinal transcription factors nodal and other TGF-beta signaling molecules. We also found that TIKI1/2 is required for proper sizing of the anterior neuroectoderm, likely through antagonism of the Wnt8-Fzd5/8-JNK signaling pathway. Furthermore, our functional analyses indicated that Fzd5/8 is required for tiki1/2 expression in the anterior pole, which may serve as a negative feedback loop. Notably, our data also indicate that TIKI1/2 is required for embryonic skeletogenesis by affecting PMC migration. Together, these results suggests that TIKI1/2 is critical in the regulation of Wnt/JNK signaling during A/P axis pattering and functions broadly to regulate the Wnt ligand activity during sea urchin embryogenesis.

Title: Invasive plant species mapping using PlanetScope imagery at AmeriCorps sites: A pilot study

Primary Author: Mary Stewart

Additional Authors: Lana Narine;Allie McCreary;

Department/Program: AU National Resource Management and Development Institute

College: College of Forestry, Wildlife and Environment

Abstract: AmeriCorps is a federal agency that works with governmental and non-governmental organizations. AmeriCorps members assigned to locally based Conservation Corps organizations create more resilient greenspaces through trail restoration, enhancing biodiversity, and reducing invasive species coverage. Conventional evaluation of invasive removal projects involve fieldwork that is often cost-prohibitive and time and labor-intensive. The use of remote sensing data to evaluate ecosystem structure and composition has been demonstrated, and thus, can be used in addition to conventional methods to achieve spatially comprehensive coverage. The goal of this study is to develop remote sensing-based approaches to evaluate invasive species removal programs by Conservation Corps groups. The objectives are to: 1) develop an approach to detect four invasive species (Carduus nutans, Elaeagnus angustifolia, Tamarix chinensis, and Bassia scoparia) using 3 m Planet imagery and 2) create pre- and post-treatment distribution maps of each species across two study sites. One site is located in Grand Teton National Park in Wyoming and the second is in Grand Junction, Colorado. At each site, Conservation Corps crews collected field data for model training and testing. The spatial data was Planet level 3B Surface Reflectance data with 8 spectral bands with a 3 m2 resolution. The normalized difference vegetation index (NDVI) and two texture metrics from the NIR band were derived and combined with image bands for a total of 11 predictor variables. Minimum distance and random forest algorithms were used to classify the Planet imagery. The random forest model yielded an overall accuracy of 98.3% for the site in WY and 96.5% overall accuracy for the site in CO. However, accurate delineation of the four invasive species highlights a crucial need for additional field data for model training and validation due to an inability to supplement field data with visual observations.

Title: Immersive Learning in Agriculture: Harnessing AR and VR for CEA Education

Primary Author: Maryam Bigonah

Additional Authors: Daniela Marghitu;SASIKIRAN REDDY NALLAPAREDDY;Aparana Pant;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Agriculture, one of humanity's most essential endeavors, is now at the forefront of a digital revolution. The convergence of Augmented Reality (AR) and Virtual Reality (VR) with agricultural education presents an unprecedented opportunity to transform how we learn about and engage with food production systems. These cutting-edge technologies create immersive and interactive experiences, allowing learners to explore complex agricultural processes in ways that were previously unimaginable. This research focuses on leveraging AR and VR to teach Controlled Environment Agriculture (CEA), a sustainable method of cultivating crops in precisely controlled settings like greenhouses and indoor farms. By combining innovative technology with education, the study aims to inspire high school students and adult learners to embrace sustainable practices and contribute to the future of food security. Central to this effort is the creation of an accessible gamified and educational application that aligns with the universal design guidelines, ensuring that students of all abilities can benefit. The application incorporates gamified and dynamic learning modules that simplify complex CEA concepts through hands-on, interactive experiences. Through the application, students can explore various sections of a greenhouse, gaining hands-on familiarity with agricultural systems such as hydroponics. In addition, the study evaluates how gamified elements influence engagement and how the application caters to diverse learning needs, particularly for students with disabilities. This study underscores the importance of integrating technology into agricultural education, providing students with immersive and inclusive learning experiences. By bridging the gap between traditional methods and modern innovations, it equips the next generation with the knowledge and skills needed to contribute to a more sustainable and technologically advanced future.

Title: Potential of biochar to reduce greenhouse gas emissions in cotton production system

Primary Author: Maryam Saeed

Additional Authors: Dexter Watts;Debolina Chakraborty;Rishi Prasad;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The continuous increase in fertilizer prices has led farmers to think about other alternative nutrient sources, such as manure. At the same time, the question about the effect of fertilizer and manure application on greenhouse gas (GHG: CO2, N2O, CH4) emissions has been a concern. Biochar, a carbon-rich substance is becoming popular as a sustainable solution because of its high specific surface area and adsorption capacity. However, there is a knowledge gap in identifying the optimal biochar application rate and method for reducing GHG emissions from Southern United States soils. This study aimed at evaluating the potential of combined application of biochar, broiler litter (BL) and urea fertilizer on the mitigation of GHG emissions from cotton production systems in SE US. An experiment was conducted at Wiregrass Research Station, Alabama using four rates of biochar (0, 4.4, 8.9, and 17.9-Mg/ha), with nitrogen fertilizer (135-kg/ha) and BL (4.4-Mg/ha) in randomized complete block design with four replicates. All the treatments were applied one week prior to planting cotton. Nitrogen (N) fertilizer was applied in two splits. GHG samples were collected biweekly using static chambers and analyzed in gas chromatography. First year results indicate that the application of a higher rate of biochar (17.9-Mg/ha) with BL reduces GHG emissions from the soil. However, we observed a significant decrease in the emissions of GHG when low rates of biochar (4.4-Mg/ha) were applied with fertilizer. Such findings indicate that biochar application at variable rates has differential effects on GHG emissions when applied with varying sources of nutrients. The information generated in the present study can help develop management strategies for sustainable cotton production by reducing GHG emissions from soil.

Title: Effects of duck breeds on egg functionality through fourteen days of egg storage

Primary Author: Matthew Hughes

Additional Authors: Karla Casco Gomez;Brigid McCrea;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: In recent years, duck egg consumption in the US has increased. Duck eggs have been sought out due to their larger size and better baking functionality. The goal of this study was to evaluate how egg functionality differs between duck breeds and how they change during storage. Eggs from 5 breeds (Jumbo Pekin-JP, Rouen-R, Pekin-P, Mallard-M, Khaki Campbell-KC) were obtained from a commercial duck producer, raised on the same farm with the same diet. Eggs were kept at 3 oC/93%RH for the duration of the trial. Eggs from each breed were divided into 3 days of sampling (Day (D) 0, D7, D14). Egg functionality tests performed were angel food cake (volume), custard (weep, height, texture), and mayonnaise (mayonnaise color (LAB), texture). Statistical analysis was performed using the General Linear Models procedure with means separated by LS Means. JP angel food cake volume was higher than all other breeds ($P<0.0001$). Volume increased from D0-D7 and stayed the same from D7-D14 ($P<0.0001$). Custard weep was highest for R followed by M, P, JP, and KC ($P=0.0021$). Weep increased from D0-D7 and decreased from D7-D14 ($P=0.0011$). Custard height was not different between breeds ($P=0.0687$). Height increased from D0-D7 and decreased from D7-D14 ($P=0.0003$). JP had the firmest custard followed by KC, R, M, and P ($P=0.0129$). Custard became firmer from D0-D7 and softer from D7-D14 ($P=0.0001$). Mayonnaise L* value did not differ by breed or day ($P=0.1425$, $P=0.0700$). KC had the greenest mayonnaise followed by R, M, JP, and P ($P<0.0001$). JP had the yellowest mayonnaise followed by KC, JP, P, and M ($P<0.0001$). Mayonnaise became less green from D0-D7 and more green from D7-D14 ($P=0.0003$). Mayonnaise yellowness decreased as eggs aged ($P<0.0001$). R and P had the firmest mayonnaise followed by KC, JP, and M ($P<0.0001$). Mayonnaise became softer from D0-D7 and firmer from D7-D14 ($P<0.0001$). There were observed differences between the different duck breeds. These differences may influence the suitability for different product preparation purposes.

Title: Exploring effects of ball scaling on peak segmental velocities timing in youth baseball.

Primary Author: Matthew Poczatek

Additional Authors: Gretchen Oliver;Caroline Keller;Anthony Fava;Billy Lozowski;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Proximal-to-distal (PD) sequencing and timing of segmental velocities are thought to be essential for reducing excessive joint stress during baseball pitching. Recently, research has indicated that modifications in ball size and weight can also achieve similar outcomes. Since a PD sequence may not occur consistently during pitching, the timing between peak segmental velocities could be of greater importance. Therefore, this study aimed to determine if the timing between peak linear velocities for five segments would be affected when throwing differently sized/weighted baseballs. Kinematic data for 13 youth baseball pitchers (1.40 ± 0.10m; 44.5 ± 14.3kg; 10 ± 1y) were collected using an electromagnetic motion capture system (240Hz). Each pitcher threw 15 game-intensity fastballs from a mound toward a target strike zone. Five pitches were thrown with a regulation leather baseball (Reg), five with a 3D printed ball identical in size and mass to the regulation baseball (ST), and five with a 3D printed ball that was scaled based on mean age group (9-10 & 11-12 years) hand size (SC). Variables of interest were the time between peak linear velocities of the pelvis and shoulder; shoulder and elbow; elbow and wrist; and wrist and finger. All data processing and statistical analyses were performed in R Studio (Posit PBC, Boston, MA). General linear models determined if differences in duration were significant between balls. Scaling baseballs did not alter the timing between peak segmental velocities in either age group (all ps > .05). This suggests that youth baseball pitchers' throwing patterns might be stable enough at early stages of development (~9 years old) to counter any potential disruptions caused by smaller balls. With the consistency of relative timing observed here, even after altering ball size and mass, one might conclude that when teaching pitching technique, focusing on efficient mechanics may be more pragmatic than on specifics like timing.

Title: ExSiM: Explainable Methodology to Upgrade Sentence Similarity Metrics to Document-Level

Primary Author: Matthew Williams

Additional Authors: Shubhra Kanti Karmaker Santu;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Document similarity metrics tend to be black boxes. Previous best-performing methods take documents as a complete text and does not perform sub-document comparisons. This poses a challenge for determining how to improve these metrics alongside what the correct use cases are for them. To open a new direction that will alleviate these issues, this paper introduces a methodology that can take sentence similarity metrics and expand them into document similarity metrics. This is also done in a general way to allow other such transformations, like paragraph to document. This is achieved through an analytic intuition-based methodology for constructing document similarity metrics inspired by how humans read texts. We compare sentence to sentence, paragraph to paragraph, building up to document to document. Thus, we hope to allow greater explainability for document similarity metrics while also paving the way for further improvements in the domain.

Title: Strawberry production in hydroponic system viability and challenges

Primary Author: Maverick Mariquit

Additional Authors: Brenda Ortiz;Elina Coneva;Paul Bartley;

Department/Program: Horticulture

College: College of Agriculture

Abstract: The viability of strawberry cultivation in hydroponic systems at the Plant Science Research Center in Auburn, Alabama, has demonstrated positive results. The two cultivars grown, 'Albion' and San Andreas', shown similarities in plant and flower phenology, numerically vary in photosynthesis and biomass, but significantly differ in yield. Both cultivars have a higher yield when contrasted to the 2022 US average yield. The improved yield of strawberries in hydroponics under greenhouse might be due to the regulated environment and optimization of nutrients that are favorable to the plants. However, there are significant challenges to overcome, including the need for rigorous nutrient control, the substantial initial investment, and potential issues with pests and system maintenance. Although these constraints, the future feasibility of this innovative strawberry cultivation method is further enhanced by ongoing advancements in hydroponic technology and culture methods.The viability of strawberry cultivation in hydroponic systems at the Plant Science Research Center in Auburn, Alabama, has demonstrated positive results. The two cultivars grown, 'Albion' and San Andreas', shown similarities in plant and flower phenology, numerically vary in photosynthesis and biomass, but significantly differ in yield. Both cultivars have a higher yield when contrasted to the 2022 US average yield. The improved yield of strawberries in hydroponics under greenhouse might be due to the regulated environment and optimization of nutrients that are favorable to the plants. However, there are significant challenges to overcome, including the need for rigorous nutrient control, the substantial initial investment, and potential issues with pests and system maintenance. Although these constraints, the future feasibility of this innovative strawberry cultivation method is further enhanced by ongoing advancements in hydroponic technology and culture methods.

Title: Improving human-exoskeleton coordination through modification of the torque's rise and fall time control parameters in powered ankle exoskeleton

Primary Author: Max Miller

Additional Authors:

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: Exoskeletons have become increasingly popular due to their potential to enhance or assist human capabilities across various industries, such as manufacturing and healthcare. Lower-extremity powered exoskeletons are driven by controllers that store commands to assist the user. However, they still have their own unique set of complexities and unknowns. It needs to be determined how changes in exoskeleton control parameters can affect human-exoskeleton coordination. Changes in exoskeleton parameters, such as ankle timing and quasi-stiffness, can influence gait characteristics and muscle activation, affecting human performance. This research aims to develop a new exoskeleton controller for the Dephy ExoBoot to modify the torque profile's rise and fall time (exoskeleton parameters) and evaluate people's sensitivity to the changes and associated changes in gait characteristics. The Dephy ExoBoot provides torque/assistance at the push-off during the stance phase of the gait cycle. To provide the assistance, the actuator produces a torque about the ankle joint by spooling an inelastic belt that is rigidly attached to the exoskeleton's lever arm. The results from this pilot study will provide a preliminary understanding of human perception towards changes in exoskeleton control parameters, which offers insight into individual preferences and differences in exoskeleton usage and informs exoskeleton precision requirements to maximize human-system interaction, improving human performance.

Title: Public Perceptions of Stuttering on Auburn University's Campus

Primary Author: McCarley Rickman

Additional Authors:

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Background: Previous research has shown that public perceptions of stuttering differ among communities, settings, and countries (Chastain & Bettagere, 2016; St. Louis et al., 2016; Williams et al., 2023). Moreover, people who stutter must deal with stereotypes about stuttering throughout their life (Guitar, 2013; Schlagheck et al., 2009). The current study examined public perceptions of stuttering on Auburn University's (AU) campus. We hypothesized that SLHS students may have more knowledge than other students and would also view people who stutter more favorably given their training. Methods: Students enrolled at AU were recruited using fliers and word of mouth. The survey gathered demographic information about age, gender, race, and ethnicity. Likert scales ranging from strongly agree to strongly disagree were used investigate views of stuttering and the participants' knowledge of stuttering. ReCAPTCHA Score, Relevant ID Duplicate Score, and Relevant ID Fraud Score were used to omit responses that were likely generated by bots. Responses were separated into three groups based on major: 1) SLHS major, 2) Healthcare/Education major, 3) Other major (e.g., physics, business, etc.). Results: A total of 399 responses were collected in the fall 2024 semester. A total of 140 survey responses met the inclusion criteria for our study (undergrads = 128, grads = 12). Of the 140 respondents, 137 = female, 2 = male, and 1 = nonbinary. Overall, results indicate that students, regardless of major, have a favorable view of adults who stutter. However, statistically significant differences exist based on the level or favorability with students in SLHS showing the greatest degree of favorability. Conclusion: Results of the study will be discussed to further elaborate AU students' knowledge and impression of stuttering. Findings of the study indicate basic knowledge of the cause of stuttering; however, misconceptions of the etiology still exist, even among SLHS students.

Title: Why are male sliders small? The role of sexual selection in maintaining male size in a pond turtle

Primary Author: McKae Sarkowski

Additional Authors: Iwo Gross;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Sexual selection is crucial to an individual's reproductive success, favoring traits that increase mating success when reproductive competition is present. Sexual selection drives evolutionary and ecological patterns such as morphological differences between males and females of the same species. Despite this, sexual selection has rarely been studied in turtles, and consequently, the degree to which sexual selection has shaped sexually dimorphic characters remains unknown. Although mating experiments have scarcely been conducted in turtles due to the difficulty of observing mating behaviors in water, recent advancements in technology have made observing these behaviors in the wild increasingly feasible. We hypothesize that sexual dimorphism in aquatic turtles is maintained through sexual selection in males. To reflect this, we are evaluating the extent to which male body size in yellow-bellied slider turtles (Trachemys scripta) influences their mating behavior. If sexual selection favors smaller male size, we predict a negative correlation between mating rate and size among males. To measure mating rate, we use 3D-printed female decoys designed to hold a passive integrated transponder (PIT) tag reader that records when previously PIT-tagged males approach either decoy within close range (<40cm). Each unique PIT-tag identification number corresponds to body measurements for each male that has been recorded as part of an ongoing mark-recapture study within this mating system. Despite turtles showing a range of sexual dimorphism, direct empirical tests of evolutionary hypotheses to explain these patterns have rarely been conducted. This novel, direct approach will provide insight as to whether male body size in turtles is influenced by sexual selection, therefore impacting their mating success.

Title: Mechanism guided two-electron energy storage for redox-flow batteries using nickel bis(diphosphine) complexes

Primary Author: Md Musharraf Hossain

Additional Authors:

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: The unique architecture of redox flow batteries (RFBs), which decouples energy density from power density, has encouraged scientists to consider them a promising renewable energy storage system for grid scale applications due to their safety, cost-effectiveness, and durability. In RFBs, redox-active molecules are used to store and release energy as anolytes and catholytes in solutions. The energy stored ($\Delta G = -nFEcell$) depends on the number of electrons (n) transferred per molecule and the potential difference between catholyte potential (Ec) and anolyte potential (Ea) where Ecell = Ec - Ea. Increasing energy density and finding redox-active molecules of high stability are the two main challenges for practical use of RFBs. In this study, we investigated easily synthesized, highly stable, and soluble nickel(II) bis(diphosphine) complexes for anolytes in RFBs, which undergo electrochemically reversible two-electron redox reactions at notably negative reduction potentials in acetonitrile (MeCN) solvent. For example, [Ni(dmpe)2](BF4)2, where dmpe = 1,2-bis(dimethylphosphino)ethane, undergoes a reversible 1 x 2e- reduction to Ni(dmpe)2 at -1.36 V vs Fc+/0 and exhibits solubility about 1 M in MeCN. Our studies have shown that halide (X- = Cl^-, Br^-, I^-) electrolyte conditions have significant impact on solubility, electrochemistry, and cycling stability of nickel(II) bis(diphosphine) complexes. It has been observed that the X^- ions increase the reduction potential to a more negative value, convert 2 x 1e- redox process to 1 x 2e- redox reaction, and enhance the charge-discharge cycling performance. We also found that addition of diphosphine ligands further improve the cycling performance of nickel(II) bis(diphosphine) complexes. Our focus will be the comprehensive understanding of redox mechanism of nickel (II) bis(diphosphine) complexes by analyzing data from scan rate dependent cyclic voltammetry (CV) studies, DigiElch modeling, UV-vis spectroscopy, and 31P NMR spectroscopy. The insights gained from this research will enhance our understanding of using multi-electron inorganic redox couples and design new complexes as suitable anolytes for practical RFB applications.

Title: Enhancing work zone safety with smart wristband and LED helmet

Primary Author: Md Roknuzzaman

Additional Authors: Li Quan;Tonghui Li;NsongErnest Asiedu;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Work zone safety remains a critical concern, with 96,000 crashes resulting in 37,000 injuries and 891 fatalities in 2022. Speeding is a major contributor, accounting for 34% of these fatal incidents. Current countermeasures such as changeable traffic signs and digital speed monitors help, but additional solutions are needed. This study proposes the idea of an integrated safety system combining a smart wristband and an LED helmet with a speed detection system to enhance work zone safety. The proposed system consists of two main components: a risk perception module and a smart warning module. Application scenarios include hierarchical risk management, where wearable devices issue different levels of alerts based on environmental factors such as speed, lighting conditions, and weather. The system aims to enhance worker visibility and response time, minimizing accidents. By integrating advanced sensing, wearable technology, and real-time alerts, this project seeks to significantly improve work zone safety. The system not only enhances worker awareness but also provides critical warnings to speeding drivers, potentially reducing accidents and fatalities in high-risk areas.

Title: A graph convolutional network approach for hyperspectral image analysis of blueberries physiological traits under drought stress

Primary Author: Md. Hasibur Rahman

Additional Authors:

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Blueberries are extremely susceptible to drought due to their shallow root systems and limited water regulation capabilities. Climate change exacerbates drought stress in major blueberry production regions, which affect key physiological traits, such as leaf water content (LWC), photosynthesis (A), stomatal conductance (gs), electron transport rate (ETR), photosystem II efficiency (ϕPSII) and transpiration rate (E). Current phenotyping methods for measuring these physiological traits are time-consuming and labor-intensive as well as limited by the need for specialized equipment. To address this, a high-throughput phenotyping (HTPP) platform integrated with hyperspectral camera and a novel graph convolutional network (GCN)-based model, Plant-GCN, was developed to predict physiological traits of blueberry plants under drought stress. Spectral reflectance obtained from the hyperspectral images were transformed into a graph representation, with each plant represented as a node, spectral reflectance as node features, and edges defined by spectral similarities. The Plant-GCN model utilizes graph convolutional layers that aggregate information from neighboring nodes, effectively capturing complex interactions in the spectral signature and enhancing the prediction of physiological traits. Plant-GCN achieved a coefficient of determination (R^2) of 0.89 for LWC, 0.94 for A, 0.89 for gs, 0.92 for ETR, 0.93 for ϕPSII and 0.89 for E on the test dataset. The performance of the proposed Plant-GCN model was compared with multilayer perceptron (MLP), partial least squares regression (PLSR), support vector regression (SVR), and random forest (RF), and it consistently outperformed all these models as well as data published in other reports. The high-throughput phenotyping system enabled efficient large-scale data collection, while the Plant-GCN model captured long-range spectral relationships significantly improved the prediction of physiological traits. The high predictability of the models could facilitate the screening of blue-berry cultivars for the specified traits allowing the selection and breeding of new drought tolerant cultivars in the future.

Title: Development of Effective Herbicide Mixture of Copper Sulfate and Diquat to Address Microcystis in Aquaculture Ponds

Primary Author: Md. Sayem Ahmed

Additional Authors: Tham Hoang;Andrew Barrick;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Harmful algal blooms pose a major threat to aquaculture ponds. Alabama Catfish ponds creates ideal condition for bloom formation due to high nutrient load, stagnant water conditions, and high temperatures. Copper sulfate is commonly used to treat cyanobacterial algal blooms, but its applications can be erratic because fast sedimentation and potential accumulation over time. Additionally, some cyanobacteria can response differently with herbicides. This study investigates the effects of a chemical mixture of Copper sulfate and Diquat to two cyanobacterial strains- field isolated Microcystis sp. and standard algae UTEX 3037 (Microcystis aeruginosa). The study investigates possible interactions between the two compounds and hypothesizes an additive effect wherein a 50% combination of copper and diquat generates the same EC50 as the separate compounds. Seven different mixture concentration of copper and diquat is used based on toxic unit. The EC50 value of the mixtures suggest an additive effect on algal remediation. Controlling cyanobacterial blooms in aquaculture ponds might find a more consistent and ecologically friendly answer in this method.

Title: How do ribosomes make proteins? Direct tracking of translation with single-molecule FRET

Primary Author: Megan Fitzgerald

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Proteins are the building blocks of all organisms. Regulation of protein synthesis defines when and where proteins will be made and thus is central to many cellular and organismal functions. Mistranslation of proteins is related to almost every human disease. Ribosomes sequentially read mRNA during translation, though knowledge of its mechanism is not fully understood. During translation initiation, a small ribosomal subunit moves along mRNA in search of a start codon during a process called scanning. Förster Resonance Energy Transfer (FRET) can be used to determine the distance between two fluorescent dyes. The protein RPS26A was tagged on a small eukaryotic ribosomal subunit with a short peptide (ybbR) tag using CRISPR-Cas to study scanning initiation. It was purified and fluorescently labeled through an enzymatic reaction catalyzed by Sfp transferase. FRET changes when the ribosome's position on mRNA is fixed by adding a tRNA molecule. This system can be used in the future to study scanning initiation, elongation, and frameshifting during translation. In the elongation phase of protein synthesis, ribosomes step precisely by three nucleotides toward the 3' end of mRNA upon reading each codon. Translocation, a process where the tRNA changes positions in the ribosome, occurs during elongation. A double deletion strain of yeast for fluorescently labeling RPL36A and RPL1B was experimented with to understand intrasubunit conformation during translocation in the future. A Q tag was inserted onto the N-terminal of RPL36A, which is on the large subunit. Labeling experiments with these mutated ribosomes show an active labeling enzyme. Future directions include introducing ybbR on RPL1B, optimizing dual labeling, large-scale purification of ribosomes, and analyzing FRET between dyes.

Title: Plasma and complement proteins are essential for the antimicrobial activity of canine platelet lysate

Primary Author: Melikasadat Mollabashi

Additional Authors: Maria Naskou;Scarlett Sumner;Matt Murray;Alonza Klopfer;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Platelets play a crucial role during the inflammatory phase of wound healing due to the release of chemokines, proteins, cytokines, and growth factors. They also have antimicrobial peptides which contribute to their antimicrobial properties. Factors affecting the effectiveness of platelet products in wound healing include the manufacturing process, platelet concentration, leukocyte content, method for platelet activation, and pooling of individual donors. In this study, blood was collected from eight purpose-bred dogs. Platelet-rich plasma was produced using two centrifugation methods, one leukocyte-rich and one leukocyte-reduced. A portion of the samples was processed for plasma depletion and platelet lysate was subsequently generated through freeze-thaw cycles. A portion of platelet lysate samples underwent heat treatment. All treatment groups were tested against four common bacteria found in canine skin wounds: Escherichia coli, Enterococcus faecalis, Staphylococcus pseudintermedius, and Staphylococcus aureus. Effects on bacterial inhibition were evaluated via a bacteria spiking assay. After 3 hours, platelet lysate showed a statistically significant reduction in E. coli and S. aureus bacteria cultures. No significant differences were observed between leukocyte-rich and leukocyte-reduced lysate formulation. Plasma depletion increased the growth of S. pseud but reduced the growth of E. faecalis after 3 hours. In comparison to platelet lysate, E. faecalis growth was significantly higher due to heat-induced deactivation of plasma complement proteins after 24 hours.According to the results, plasma and complement proteins seem to be critical for inhibiting the growth of some bacterial strains although leukocyte concentration is not essential for this goal. Our future experiments will evaluate the synergistic effects of PL with antibiotics against bacterial wounds in canines.

Title: Exploring prenatal predictors of childhood obesity in a comprehensive literature review

Primary Author: Melike Coskun

Additional Authors: Nila Shakiba;Hanna Jennings;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Childhood obesity is a significant health issue in the U.S. According to the Centers for Disease Control and Prevention (CDC), data from 2017 to 2020 show that almost 1 in 5 children and adolescents were obese. In Alabama, the CDC reported that in 2023, nearly 2 in 5 people (39.2%) had obesity, ranking Alabama as the fifth highest state for obesity. Childhood obesity is linked to a wide range of health problems, including stroke, high blood pressure, diabetes, sleep apnea, asthma, depression, anxiety, chronic diseases, and increased morbidity later in life (Ayine et al., 2020). In 2019, the medical cost of obesity among children was $1.3 billion US dollars. Therefore, identifying the early life risk factors for childhood obesity is essential to implementing effective prevention. Most research has focused largely on identifying the risk factors for childhood obesity during early and late childhood, including high birth weight, excessive weight gain, shorter breastfeeding duration, problematic eating patterns, poor nutritional diet, lack of physical activity, poor sleep, and sociodemographic factors. However, emerging evidence highlights the importance of identifying the risk factors as early as prenatal periods. The primary aim of this literature review is to explore the perinatal risk factors for childhood obesity, with a specific focus on the mother's gestational weight gain or prior obesity, tobacco use, poor maternal nutrition and diet, sleep problems, lack of physical activity, and maternal psychological problems during pregnancy (Baidal et al., 2016; Córdoba-Rodríguez et al., 2022; Sacco et al., 2013; Qureshi et al., 2018). The literature review will be guided by the Developmental Origins of Health and Disease (DOHaD) framework, which suggests that environmental factors during early life can permanently affect the onset of health problems by increasing the risk of diseases in later life (Lacagnina, 2019).

Title: Advancing Health Equity: The Auburn University Rural Health Initiative in Underserved Communities

Primary Author: Melissa Garnes

Additional Authors: Linda Gibson-Young;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: The Auburn University Rural Health Initiative (AURHI) is a transformative program addressing health disparities in underserved counties across Alabama. This initiative focuses on delivering sustainable solutions to improve access to care, promote health education, and address chronic disease management in rural and underserved environments. AURHI operates in 14 counties, with a particular emphasis on areas facing significant barriers to healthcare access due to socioeconomic and geographic challenges. AURHI employs a multifaceted approach, leveraging partnerships with local organizations, community leaders, and healthcare providers to implement tailored interventions. Key components include community-based education programs targeting maternal and infant health, diabetes, hypertension, and mental health. These efforts are supported by a diverse team of nurses, faculty, and students who collaborate to design and deliver culturally sensitive care. In 2023, 190 university faculty, staff, and students visited the center to understand services provided and how their curricula could intersect. In this presentation, intern Melissa Garnes will highlight AURHI's innovative programs such as the East Alabama Mobile Health Clinic andOnMed Care Stations. The Chambers County 2023 Impact Report revealed that 97% of patient consults indicated their health needs were met very well or well, showcasing AURHI's effectiveness in meeting community health needs. AURHI's programs have reached thousands of Alabama's residents with 3,200 OnMed Care Station visits recorded from March 2022 through December 2024. The presentation will also discuss the student's role in program implementation, emphasizing the importance of interprofessional collaboration, community trust-building, and advocacy. By showcasing AURHI's successes and lessons learned, the presentation will inspire actionable strategies for reducing health disparities and fostering health equity in underserved communities.

Title: Perceived susceptibility and severity of stimulant misuse among the U.S. general public: a national cross-sectional survey

Primary Author: Melissa Sanders

Additional Authors: Lindsey Hohmann;Erin Blythe;Kat Smith;Madison Holland;

Department/Program: Phamacy

College: Harrison College of Pharmacy

Abstract: Prescription and non-prescription stimulant misuse is a rising concern in the United States. Previous research has predominantly focused on the college-age population; therefore, the purpose of this study was to better understand the U.S. general public's perceived susceptibility to and severity of stimulant misuse. A cross-sectional study design was utilized, with U.S. adults ≥ 18 years recruited to participate in an anonymous online survey. The survey instrument, developed de novo and informed by B.A. Kinman and the Health Belief Model (HBM), assessed perceived susceptibility and severity via 5-point Likert-type scales from 1=strongly disagree to 5=strongly agree. The data was analyzed descriptively. Overall, mean [SD] perceived susceptibility to stimulant misuse was higher for prescription versus non-prescription stimulants (scale score: 3.87 [0.64] versus 3.76 [0.73]). In particular, 77.6% of respondents agreed or strongly agreed that it is easy to become addicted to prescription stimulants and 37.1% stated that prescription stimulant misuse is common in their community. Perceived severity of stimulant misuse was higher for non-prescription versus prescription stimulants (4.45 [0.62] versus 3.92 [0.64]). Specifically, 88.6% believed that taking non-prescription stimulants would put a strain on their close relationships, while 50.8% believed the same for prescription stimulants. Approximately 94% stated that taking non-prescription stimulants would cause long-lasting bodily harm, compared to 88.6% for prescription stimulants. Perceived susceptibility to and severity of stimulant misuse were relatively high amongst U.S. adults. Findings from this study may contribute to increased awareness of prescription and non-prescription stimulant misuse, and future studies should investigate the association of perceived susceptibility and severity with stimulant misuse intentions and actual misuse behaviors.

Title: Evaluation of strawberry cultivars in Central Alabama

Primary Author: Meliza Sandoval Salvador

Additional Authors: Sushan Ru;Edgar Vinson;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Strawberry is one of the top fruits produced in Alabama, following peaches and blueberries. However, strawberry production in Alabama falls behind compared to major producers such as California and Florida due to a lack of suitable cultivars. Identifying cultivars well-suited to the Southeast's growing conditions is critical for optimizing production and ensuring high-quality fruit. Camarosa has been the most dominant cultivar in Alabama, however, it is facing increasing challenges with diseases such as anthracnose. To introduce new cultivars to Alabama, a cultivar trial was initiated in 2023 to evaluate five strawberry cultivars—Camarosa, Victor, Ruby June, Royal Royce, and Radiance—at the E.V. Smith Research Unit in Tallassee, AL, and Chilton Research and Extension Center in Clanton, AL. Strawberries were planted in black mulch-covered raised beds in an open field using a randomized complete block design, with four blocks and four replications per block at each location. Data collection was conducted weekly during the harvested season for total yield per plant (g), berry weight (g), total soluble solids (°Brix), titratable acidity (TA, %), and mortality rate (%). Camarosa remained to be the top cultivar in terms of overall performance; on the other hand, Victor exhibited comparable yield and bigger berry size than Camarosa. Radiance exhibited the highest mortality rate. Throughout the season, °Brix and TA tended to decrease as the season progressed, with some cultivars experiencing a sharper decline than others. These findings provide valuable insights for growers in Alabama regarding cultivar selection.

Title: Advancing cardiovascular health in underserved Alabama communities through self-monitoring and community-based interventions

Primary Author: Mia Jensen

Additional Authors: Linda Gibson-Young;Zach Hutchison;Nina Stute;

Department/Program: Nursing

College: College of Nursing

Abstract: Cardiovascular disease (CVD) remains a leading cause of mortality, disproportionately affecting rural and underserved populations due to limited healthcare access. Our initiative, funded by the CDC Cardiovascular Health Grant, aims to improve hypertension management and reduce CVD risk in Chambers and Macon counties, Alabama, through self-measured blood pressure (BP) monitoring and community-based education. Participants are recruited via healthcare provider referrals, community outreach, and screenings at local events. Eligible individuals—adults aged 18 and older with hypertension or high CVD risk—provide informed consent before enrollment. Data collection includes self-reported BP readings, structured interviews, and validated surveys, including the Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE) tool to assess social determinants of health. Participants receive training on BP monitoring and record multiple daily measurements, which are reviewed during follow-ups. Our interventions integrate lifestyle education, telehealth support, and home BP monitoring. A nutrition class, led by an Auburn University student, provided eight attendees with evidence-based dietary strategies. We systematically track BP control by race, ethnicity, and socioeconomic status while collaborating with healthcare providers to address social service needs such as transportation and food security. A multidisciplinary team—including nurses, kinesiology experts, nutritionists, and community health workers—ensures program sustainability. Early findings indicate increased BP awareness and improved adherence to medication and lifestyle modifications, demonstrating the potential for long-term CVD risk reduction in underserved populations.

Title: Post-operative indicators of complication rates and survival to discharge

Primary Author: Micah Goode

Additional Authors: Kira Noordwijk;

Department/Program: CVM

College: College of Veterinary Medicine

Abstract: The primary goal of this study was to review post-operative blood work to identify indicators of post-operative recovery length, complications, and prognosis of survival to discharge. Pre-operative indicators of survival and complications have been reported, but few have analyzed post-operative indicators for complications and survival to discharge. With a better understanding of post-operative indicator, treatment and prognosis for recovery can be better tailored to each patient. Indicator may identify risks for complication and allow for earlier treatment or management to prevent post-operative complications. A retrospective analysis of 336 colic cases was performed that underwent a celiotomy at AUCVM from 2016-2024. Pre-operative values recorded included intake vitals, nasogastric reflux, ultrasound findings, and blood work. Additionally, surgical survival, the type of colic, surgical time, duration of anesthesia, and surgical procedures. Post-operative values included time to normal vital parameters, relapses of increased vital parameters, time to fecal production, nasogastric reflux, post-operative blood work values, complications, and euthanasia prior to discharge. Of 329 cases, 89 (27%) were euthanized during surgery and 181 (55%) survived to discharge. There was no significant difference in white blood cell count or neutrophil count between horses that survive to discharge or were euthanized following surgery. Toxic changes in neutrophils was higher in horses that survived to discharge (t=0.02). The occurrence of post operative pneumonia did not affect survival to discharge. Factors considered to be negative indicators of survival were not found to be significantly different between horses that survived to discharge and horses euthanized prior to discharge. Large study sample and further analysis would be required to further identify indicators of post operative prognosis.

Title: Assessment of water quality at Moore's Mill creek watershed using PCSWMM

Primary Author: Michael Bragg

Additional Authors: Ashmita Poudel;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Besides the typical applications for the management of urban stormwater systems, EPA SWMM 5 can also be a helpful tool for watershed management planning. SWMM can provide hydrological and water quality predictions that can be used in the development of best management practices (BMPs) to prevent issues such as flooding or pollution. Such features are important for Moores Mill Creek (MMC) watershed in Lee County, Alabama, which is experiencing high levels of siltation. This is likely linked to rapid urban development of the Auburn-Opelika metropolitan area in recent years that produces construction runoff. As a new watershed management plan is being developed to propose a remediation approach for siltation, SWMM models are being developed as a part of an ongoing project to provide guidance as to what sub-watersheds would benefit most from BMP implementation. The overall objective is to create a SWMM model of the entire MMC watershed that accurately represents flow, depth, and water quality in terms of total suspended solids (TSS). A model of the upper reaches of MMC in the Opelika, AL area was previously calibrated to account for groundwater-surface water interactions assuming a uniform aquifer object and interflow parameters. It was found that these inclusions improved the model predictions of stream depth compared to measured depths, and the single aquifer approach was valid for this model. Recently, data has been collected for turbidity and TSS concentration at one MMC location over multiple rain events. The resulting turbidity curve allows for the calibration of pollutant buildup and washoff factors for this station. The calibrated model will offer critical insights for implementing different BMPs to restore water quality in the MMC watershed.

Title: Insecticide resistance of the mosquito, Aedes aegypti to different classes of insecticides

Primary Author: Michael Dub

Additional Authors: Nannan Liu;Dylan Brown;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Aedes aegypti is a primary vector of diseases affecting millions worldwide. In the U.S., these mosquitoes are predominantly found in the southern and southwestern regions, increasing the risk of disease transmission. Pyrethroids and organophosphates are widely used for mosquito control. However, resistance to these insecticides poses significant challenges for effective management. To investigate the evolution of resistance, we selected a field-collected A. aegypti strain, AeStA, and subjected it to permethrin and malathion selection for three generations. Resistance to permethrin developed rapidly, with resistance ratios increasing 120-, 400-, and 650-fold over three generations compared to the unselected field strain. In contrast, malathion selection did not result in resistance development. To understand the mechanism underlying permethrin resistance, we examined target site insensitivity in the voltage-gated sodium channel, the primary target of pyrethroids. Our analysis identified the F1534C mutation, caused by a T-to-G polymorphism in the sodium channel gene, as a key factor in resistance evolution. Additionally, metabolic synergism assays using piperonyl butoxide (PBO) and S,S,S-tributyl phosphorotrithioate (DEF)—inhibitors of cytochrome P450s and esterases, respectively—significantly reduced resistance levels. These findings suggest that increased metabolic detoxification by P450s and esterases represents another major resistance mechanism. This study demonstrates that multiple mechanisms contribute to permethrin resistance in A. aegypti and highlights the importance of rotating insecticides from different classes to slow resistance development and enhance the effectiveness of integrated pest management (IPM) programs.

Title: Characterization of an Optically Accessible, Solid Fuel Crossflow Combustor for Air-breathing Propulsion

Primary Author: Michael Welch

Additional Authors: James Michael;Sarang Bidwai;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: A renewed interest in air-breathing ramjet and scramjet combustors has led to an increased investigation of the combustion of solid fuels with gaseous oxidizers in recent years. Polymer-based solid fuel grains are desirable materials for these systems due to their long-term stability, simplicity, and overall combustibility. Of particular interest to air-breathing propulsion is the inclusion of micron- or nano-sized metal particles in the solid fuel grain to increase the performance of the motor. In a solid fuel-gaseous oxidizer counterflow configuration, aluminum particles released from the surface of a hydroxyl-terminated polybutadiene (HTPB) fuel strand ignited in the oxidizer region of the flame while remaining near the flame region for a relatively short residence time (~ 1 ms). To increase particle residence times near the flame, a lab-scale, optically accessible crossflow burner was constructed. An initial investigation into the flammability conditions for polyoxymethylene (POM) and polymethyl methacrylate (PMMA) with ambient air was performed. Both polymers sustained combustion without enriching oxygen from low oxidizer velocities (2.5 m/s) to the maximum facility velocity (14.0 m/s). Three CMOS sensors from different viewpoints observed flame shape and stability, and an RGBW sensor captured 8K video of the fuel grain. PMMA samples were split along their centerline to allow aluminum particles (H5 and H30 size distributions) to be sandwiched between the two halves before acetone welding them together. After releasing from the surface of the polymer, the aluminum particles ignited before exiting the combustor and continuing to burn. The findings of this study build the foundation necessary for future investigations into understanding the performance of solid fuel combustion in air-breathing ramjet engines.

Title: Social Media and Auburn Student Well-Being: Mitigating Negative Social Media Influences on Auburn Campus

Primary Author: Minseo Kang

Additional Authors: Sumin Kang;Kyeongseo Park;Sunghyun Kim;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Social media has become one of the primary ways of communication for many college students, but it is also where they spend the majority of their time (Chegeni et al., 2021). Research has shown that social media addiction is a growing concern, with studies demonstrating its positive correlation with mental health issues such as depression and stress (Chen & Xiao, 2022). According to a study conducted in 2024, the global average usage of social media was approximately 2.5 hours per day (We Are Social, DataReportal, & Hootsuite, 2024). Other studies have shown higher rates for high school and college students. Given these findings, this study aims to expand our understanding of Auburn University students' daily social media usage and the factors associated with their potential addiction. By analyzing the number of hours Auburn students spend on social media such as Instagram, Tiktok, and Youtube, and identifying the individual factors contributing to those hours, this research intends to provide significant insights into the current state of social media engagement at Auburn University. This study will be utilizing a Focus Group Interview (FGI) method, allowing for in-depth data collection on student behaviors and correlations between their social media usage and contributing factors. The findings of this research will show a numerical representation of Auburn University students' screen time on social media platforms, along with an analysis of the significant factors influencing their usage patterns. Understanding these factors will help in the development of future intervention programs to reduce social media addiction rates and minimize its negative impact on students' education and overall mental health. Ultimately, this research seeks to help Auburn students mitigate the negative influences of social media and further contribute to a better-informed approach to address this growing issue at Auburn University.

Title: YAP on repeat: How repeated activations of YAP impair hepatocyte proliferation

Primary Author: Mitchell Taylor

Additional Authors: Karel Alcedo;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Chronic liver diseases arise from repeated cycles of injury/repair and are characterized by impaired cell proliferation through poorly understood mechanisms. Yes-associated protein 1 (YAP), a transcriptional co-activator that partners with Tead transcription factors, regulates cell proliferation and is activated in conditions like metabolic-associated fatty liver disease and steatohepatitis. Although YAP is transiently activated to promote liver regeneration after injury, the long-term effects of repeated YAP activation on cell proliferation capacity remain unclear. Using an inducible YAP mouse model, we investigated whether repeated cycles of transient YAP activation impair proliferative capacity. We found that liver size did not differ significantly after multiple cycles of YAP activation. The number of Hn4a+ hepatocytes remained stable across these cycles, indicating that homeostatic balance was maintained. Additionally, the expression of the cell proliferation marker Mki67 remained responsive to YAP activation. However, immunofluorescence analysis revealed decreased Ki67+ proliferating cells after repeated YAP cycles, suggesting post-transcriptional regulation of cell proliferation through Ki67. These findings provide insight into how proliferative capacity becomes compromised during the injury-repair cycles that characterize chronic liver disease progression. Future studies will investigate the mechanisms linking repeated YAP activation to Ki67 protein regulation.

Title: Evaluation of In-situ Monitoring Techniques for Defect Detection in Additively Manufactured Ti-6Al-4V Parts

Primary Author: Mohammad Salman Yasin

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: The interest in metal additive manufacturing (AM) techniques is increasing rapidly across various industries due to its simplified value chain, decentralized production, on-demand manufacturing, lower waste, and greater design freedom. However, achieving reliable process stability and product quality remains critical and needs further research. To enable real-time process control and take corrective measures while manufacturing, the implementation of in-situ monitoring techniques has become considered. This study evaluates the efficacy of a popular in-situ monitoring system (the EOS in-situ monitoring system) to determine if it can detect variations in energy input. EOS in-situ monitoring system contains two different modules: ExposureOT and MeltPool. Both of these tools were utilized to detect variability achieved by changing laser power and hatch distance. The results indicates that the variation could be captured using the monitoring system. However, the sensitivity of ExposureOT was found to be better than that of the MeltPool system.

Title: From browsing to buying: How live streamer interaction quality influences consumers to adopt live streaming commerce for shopping

Primary Author: Mohammed Siddique

Additional Authors: Angie Lee;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Abstract: Live Streaming Commerce (LSC) is an interactive retail channel that allows brands to showcase product features in real-time for consumers through live streaming. Unlike traditional online retail channels (e.g., websites), LSC stands out due to the active interaction between streamers and audiences, such as real-time asking and answering questions, which plays a crucial role in shaping consumers' decision-making processes. The success of a live-streaming session largely depends on the ability of a streamer to interact effectively with consumers. Despite the unique and critical role of interaction between streamers and consumers in LSC, the influence of 'interaction quality' on consumers' adoption of LSC remains underexplored in the literature. To address this gap, this study explores the dimensions of interaction quality to identify the key aspects that contribute to high-quality interaction in LSC. This study explores how different LSC platforms (i.e., social media and retail channels like Amazon), with their varying features adopted by brands, moderate consumers' perceptions of LSC. This study adopts the technology acceptance model (TAM) to investigate how interaction quality, as a multidimensional antecedent variable, impacts consumers' perceived usefulness, ease of use, and enjoyment of using LSC. These perceptions, in turn, may shape their attitude toward and intention to use LSC for shopping. This study will collect data from respondents residing in the US and current users of LSC. The structural equation model will be used for path analysis. From a theoretical perspective, this study expands the scope of antecedent factors by examining interaction quality, which has not yet been explored, particularly among U.S. consumers. From a practical perspective, the insights gained from this research will help streamers and brands enhance their interaction quality effectively, ultimately improving consumers' perception of LSC and potentially driving higher sales.

Title: Cloud-Enabled Plant Segmentation and Tracking Framework for Ornamental Nursery Inventory Management

Primary Author: Mohtasim Hadi Rafi

Additional Authors: Tanzeel Rehman;Jeremy Pickens;Faraz Ahmad;Hamid Syed;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Efficient and accurate counting of plants is critical for nursery inventory management to support yield prediction, sales forecasting, and monitoring. Current practices in nurseries depend heavily on manual methods, which are labor-intensive and prone to errors. Researchers have made efforts in utilizing computer vision and deep learning to address these issues, yet a seamless solution for plant counting and inventory management remains unavailable. Image-based counting systems often struggle with classification accuracy in diverse, real-world scenarios, while tracking plants in videos faces challenges such as identity switches, misclassifications, and varying field conditions, limiting the reliability of existing methods. To overcome these challenges, we developed a cloud-based complete solution specifically for ornamental plant nursery inventory management. Our system introduces a novel tracking algorithm optimized for precision and scalability. At its core is an ensemble deep learning model that combines a transfer learning-based YOLOv11 and a CutMix-enhanced YOLOv11 model for plant detection. The ByteTrack multi object tracking framework was enhanced by adding a layer that compares segmentation masks across individual frames and the entire plant bed. This addition addressed identity switches and misclassifications, ensuring accurate plant counting even in complex field conditions. The segmentation capabilities of YOLOv11 are also utilized to generate masks for individual plants, enabling customizable plant-specific quality assessments through an interactive dashboard. The system utilizes GPS to allow users to monitor nursery plant beds on a map making it easier to monitor and track changes and updates across the plant beds. The platform is deployed in cloud with a microservice architecture where users can upload field videos and access results through an intuitive interface designed to ensure scalability. To evaluate the capabilities of the proposed framework, data was collected using an autonomous ground vehicle equipped with an OAK-D Pro camera, capturing 4K resolution videos. Experiments conducted on Azalea and Sunshine plants demonstrated the system's effectiveness, achieving a high mAP50 score of 0.981. This confirms its ability to accurately detect and track plants. This solution provides a robust framework for addressing the limitations of current methods, offering an effective and scalable approach to modernize ornamental plant inventory systems.

Title: Muscle-based swallowing intervention: A systematic review of protocol fidelity to muscle training theory and practice

Primary Author: Molly Lacy

Additional Authors: Mary Sandage;Leigh Nicholson;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Treatment for swallowing impairment often includes exercises that are designed to improve muscle function for swallowing safety. The extent to which exercise prescription adheres to well-established muscle training principles is not currently well understood. The goals of this systematic review were to identify commonly used muscle training dysphagia interventions and analyze the adherence of the interventions to the muscle training principles of specificity, dose, length of treatment, and fatigue management. A systematic review was conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Systematic Reviews Checklist. The search was limited to studies using muscle-based dysphagia interventions in English and with human participants. Databases included were Ovid MEDLINE, APA PsycInfo, and Web of Science. Database search yielded a total of 1,002 titles and abstracts, with 282 being duplicates. Authors screened 720 titles and abstracts, and 101 studies were retrieved for full text review. Eleven additional sources from citation review were included in full text review. Data was extracted from seventy sources. Most studies did not include adequate consideration of muscle training principles for specificity, intensity, frequency, length of treatment, and fatigue management. Despite the widespread use of muscle exercise-based swallowing interventions, this systematic review identified poor adherence to exercise training principles. Further research addressing the efficacy of muscle exercises to improve swallowing function should adhere to muscle training theory and practice as a means to refine service delivery and better understand clinical pathways and outcomes.

Title: Qualitative analysis of a zoonotic disease model with logistic growth

Primary Author: Monday Ogudu Nnakwe

Additional Authors:

Department/Program: Department of Mathematics and Statistics

College: College of Sciences and Mathematics

Abstract: Modeling the behavior of infectious diseases is fundamental in their management as global trade and agricultural endeavors increase. These infectious diseases, such as zoonotic diseases, mutate as they circulate within an intermediate host population, and mutations enhance their effective adaptation and transmission among humans. It is pertinent to develop robust mathematical models that capture their entire network to predict epidemic patterns, prevent outbreaks, and offer immediate interventions for public health policies. We propose an SIR model with logistic growth that accounts for a zoonotic disease mutating in an intermediate host, depicting disease transmission among three populations (wild, domestic, and human). The dynamics of these diseases, including the equilibria, the basic reproductive number of the pathogen, the stability of the equilibria and the effect of the transmission rates with the infected human population, were studied. This model holds significance for predicting the trajectory of any zoonotic disease with an intermediate host, and the outcome will support the public health industries in safeguarding humans, animals, and the environment against potential disease threats.

Title: In vitro validation of a novel candidate drug for the treatment of Prostate Cancer

Primary Author: Morgan Allen

Additional Authors: Amit Mitra;Sarah Batten;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Prostate cancer (PCa) is the second most common cancer in men, with 1 out of 8 men being diagnosed with it during their lifetime globally. Of these cases, 6 out of 10 of the men with PCa are 65 years or older. While the PCa death rate overall had declined due to earlier detection and treatment plans, recently increasing numbers of younger men are being diagnosed with PCa. These cases are more likely to become aggressive, with the incidence of highly lethal metastatic castration-resistant PCa (mCRPC) increasing as well. These more aggressive PCa variants have a higher risk of developing resistance to PCa drugs. Since taxanes are the first-line chemotherapeutic treatment for mCRPC, novel drug therapies and combination treatments are urgently needed to improve survival in patients with PCa. Clofazimine (CLF) is a potent antimicrobial that is FDA-approved for treating leprosy. We have previously demonstrated the efficacy of CLF against the drug-resistant forms of chronic myeloid leukemia and multiple myeloma through in vitro, in vivo, and ex vivo models. In this study, we demonstrated the efficacy of increasing doses of CLF as a single agent and in combination with a taxane drug, docetaxel (DTX), against a panel of PCa cell lines. The half-maximal inhibitory concentration (IC50) of CLF was determined using end-point cytotoxicity assays. The apoptotic activity following treatment was also measured to determine if CLF induces programmed cell death. Our findings validate that CLF is effective against prostate cancer and lays the groundwork for further preclinical drug development studies in our laboratory.

Title: Effects of Porous Surfaces on Oblique Impinging Shock Wave-Boundary-Layer Interaction Unsteadiness

Primary Author: Morgan Johnson

Additional Authors: Sarah Davis;Sarah Jennings;Cassandra Jones;Brian Thurow;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Past research has shown that Shock Wave Boundary Layer Interactions (SBLIs) play a critical role in supersonic flows by significantly impacting flow behaviors including stability and boundary layer growth. This research project is conducted under the guidance of the Auburn University Advanced Flow Diagnostics Laboratory, namely Dr. Brian Thurow and PhD candidate Cassandra Jones. The objective of this study is to build upon Ms. Jones' research by strategically altering porosity characteristics, such as percent porosity and gradient, to stabilize high speed flows and reduce shock-induced separation and heating. This research has various applications in the field of aerodynamics, specifically with aircraft stabilization and efficiency. SBLIs cause flow separation, which can cause increased drag, efficiency, and heating; as well as flow unsteadiness, which can cause wing buffeting and vibrations, all of which can be devastating to supersonic aircraft. In order to understand the SBLIs present in various flows, 3D printed components, a Mach 3.4 supersonic wind tunnel, Kulite pressure transducers and high-quality video footage of the flows are utilized. Firstly, the study aimed to understand the position of the SBLI, so a completely flat plate 3D printed plate was inserted into the wind tunnel. This provided insight into where a porosity gradient should be placed, and what pattern should be used. Using Computer Aided Design and 3D printing, the flat plate was altered such that the porous portion of the plate coincides with the SBLI, with the largest hole sizes being where the shock wave is impinging, and a Kulite pressure transducer before and after the interaction. Going forward, this porosity gradient will be tested at a Mach 3.4, and flow visualizations and pressure transducer data will be analyzed and researched to determine productive design alterations. These results will provide valuable insight into cost effective and efficient ways to manipulate SBLIs and stabilize shock systems. Going forward, this study seeks to contribute to the field of aerodynamics by improving aircraft performance though the development of functional porous surfaces.

Title: Childhood interparental conflict histories amplify links between interparental conflict in adolescence and poor sleep in emerging adulthood

Primary Author: Morgan Thompson

Additional Authors: Mona El Sheikh;Alexandra Ehrhardt;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Interparental conflict (IPC) is a known risk factor for youths' development. Over time, youths' early insecurity to IPC is proposed to become an entrenched pattern of responding, progressively sensitizing youth to subsequent bouts of IPC and risk for maladaptation. Implications for youths' sleep, a key bioregulatory process, remain unclear. Guided by developmental psychopathology models, we examined whether childhood IPC histories increased vulnerability to IPC in adolescence and risk for sleep problems (short, low-quality sleep) in emerging adulthood. Data were from a sociodemographically diverse sample (N=360, 51% female; 64% White, 36% Black; M income 20k–35k) across eight waves, spanning ages 8–24 (NICHD R01-HD046795). At each wave, youth reported on IPC using the Conflict Tactics Scale. In adolescence (Waves 4–6) and emerging adulthood (Waves 7–8), sleep was measured objectively via actigraphy. Multiple well-acknowledged sleep parameters were examined: duration (total minutes scored as sleep between onset and wake), efficiency (% of time asleep between onset and wake), activity (% of epochs in the night with activity), and long-wake episodes (number of wake episodes lasting ≥ 5 minutes). Using latent change score modeling, childhood IPC histories moderated proximal links between IPC in adolescence and sleep activity ($p < .001$) and long-wake episodes ($p = .001$) in emerging adulthood. Specifically, increases in IPC in adolescence were associated with increases in sleep activity and long-wake episodes from adolescence to emerging adulthood, but only for those who experienced increasing levels of IPC in childhood. Findings suggest stress amplification—youth exposed to heightened levels of IPC across both childhood and adolescence were most at-risk for sleep problems, even after they had left home. Novel findings build on the literature by considering long-term (8 waves), longitudinal effects of IPC on sleep problems in a diverse sample underrepresented in research.

Title: Teaching in Isolation: Sentiment Analysis of Recorded Lectures During the COVID-19

Primary Author: Muhammad Umer

Additional Authors:

Department/Program: McWhorter School of Building Science

College: College of Architecture, Design and Construction

Abstract: The worldwide COVID-19 shutdown in early 2020 resulted in the closure of educational institutions, profoundly affecting the global student demographic and instigating an unparalleled transition to online education. This transformation, executed under stringent deadlines and lacking strategic preparation, significantly contrasted with conventional, meticulously organized online learning. The transition underscored the significance of effective teaching practices, encompassing explicit learning objectives, stimulating course content, and interactive techniques, in addition to technological difficulties and unfamiliarity with digital tools. Students encountered considerable obstacles, such as diminished concentration, time management difficulties, inconsistent internet connectivity, and adverse emotions. Positive emotions such as joy and optimism have been demonstrated to improve academic confidence, concentration, and general success. The author personally instructed one such course in Spring 2020. In this study, the author analyzed 15 recorded lectures from a senior-level course in the Civil Engineering department at a public university in a developing country. After transcribing the video to audio, the text corpus was analyzed for its NRC lexicon based sentiment analysis using RStudio. The analysis indicated that all lectures generally expressed positive emotions, however remnants of unpleasant emotions were also evident in each. The author engaged in self-reflection and personal improvement by contemplating the emotional nuances of the lectures. This study highlights that lectures encompass more than mere technical information for intellectual enhancement; they also incorporate emotional aspects that enhance the overall learning experience.

Title: Generative AI-Based Digital Twin Pipeline for Advanced Agricultural Analytics Enabled by Synthetic Data and Zero-Shot Learning

Primary Author: Muhammad Waseem

Additional Authors: Tanzeel Rehman;Hamid Syed;Faraz Ahmad;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Accurate monitoring and management in ornamental production are often challenged by complex spatial configurations, high labor costs, and the labor-intensive nature of manual data collection and labeling. To address these issues, this study presents a comprehensive digital twin pipeline that leverages advanced generative artificial intelligence (AI) techniques alongside automated zero-shot annotation, establishing a scalable and precise system applicable to various agricultural real-world tasks. The methodology consists of two interconnected pipelines. The first pipeline constructs detailed digital twins by modeling realistic ornamental setups incorporating varying plant sizes, multiple growth stages, diverse groundcover materials, and different spatial arrangements. Empirical plant images were captured through robotic video acquisition using an Oak-D camera mounted on an Amiga platform. This was followed by keyframe extraction based on motion analysis to isolate individual plant instances. To introduce realistic variability, these images were then augmented using Kornia-based transformations, including rotation, scaling, flipping, and perspective distortions. Stable Diffusion XL (SDXL) with custom-trained Low-Rank Adaptation (LoRA) generated entirely new environment images, enhancing photorealism and diversity. The second pipeline addresses data scarcity by generating additional plant instances for underrepresented growth stages and conditions using text-to-image models, ensuring comprehensive morphological coverage. Automated zero-shot labeling was achieved by integrating Grounded DINO for text-driven bounding box detection and the Segment Anything Model (SAM) for instance segmentation, resulting in approximately 0.77 million annotated plant instances without the need for manual intervention. These synthetic datasets were employed to train the YOLOv11x-seg model, which achieved an average counting accuracy of 96.5%, a mean absolute error of 7.7, and a root mean square error of 8.31. Cross-domain evaluations further validated the model's robustness, demonstrating strong generalization across different growth stages and diverse agricultural conditions. Comprehensive performance evaluations confirm the pipeline's effectiveness in bridging the gap between AI-generated and real-world data, providing a cost-effective and efficient solution for large-scale agricultural analytics. This integrated approach reduces reliance on labor-intensive manual labeling and facilitates scalable, accurate, and adaptable monitoring systems. Rather than focusing solely on inventory management within ornamental nurseries, the presented methodology can be broadly applicable, including applications such as disease detection, growth monitoring, and yield prediction.

Title: Evaluating the performance of new rabbiteye blueberries in Alabama

Primary Author: Mula Pavani

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

Department/Program: Horticulture

College: College of Agriculture

Abstract: The rising demand for blueberries has driven a rapid industry expansion over the past 20 years. As the world's leading producer, the U.S. accounts for 32% of global production, generating over $1 billion annually. Rabbiteye blueberry (Vaccinium virgatum Ait., 2n = 6x = 72) is a climate-resilient option for small growers in the Southeast for their tolerance to biotic and abiotic stresses. However, rabbiteye blueberries are less competitive in wholesale markets due to suboptimal fruit quality. Therefore, this project aims to introduce new rabbiteye cultivars with ideal fruit quality in Alabama. A total of 22 rabbiteye genotypes have been evaluated at the E.V. Smith Research Center in Tallassee, AL and the Brewton Agricultural Research Unit in Brewton, AL. The field design followed a 'randomized complete block design' with three blocks and three plants per subplot for each location. These genotypes are being assessed for 10% and 50% bloom dates, average berry weight (g), yield per plant (g), firmness (g/mm), titratable acidity (TA %), and total soluble solid content (SSC, °Brix). In 2024, 'Brightwell' exhibited the highest °Brix value among all genotypes at both locations.'Overtime' recorded the highest yield in E.V. Smith Research Center while 'MS1234R' had higher yields in Brewton Agricultural Research Unit. 'MS1595R' and 'MS1228R' exhibited the highest acidity levels at the Brewton and E.V. Smith Research Centers, respectively.

Title: Alcohol administration disrupts intestinal autophagy to exacerbate liver injury

Primary Author: Murugadas Anbazhagan

Additional Authors: Paul Thomes;Ahmed Bakheet;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Autophagy is an essential process for various intestinal epithelial cells functions and maintenance of mucosal barrier integrity thus plays a key role in the maintenance of intestinal homeostasis. Our study examined whether alcohol disrupts intestinal autophagy to compromise the gut homeostasis and whether such autophagy changes promote alcohol-induced liver injury. Female wildtype (WT) and RFP-GFP-LC3 mice were subjected to chronic-binge ethanol administration (NIAAA feeding model) or to a control diet. We measured autophagy, lysosomal markers and cell specific markers in the duodenum and ileum of these animals, and serum ALT levels as a marker of liver injury. Compared with controls, duodenal and ileal segments from wild-type mice fed chronic-binge ethanol (EtOH) showed significant increase in mRNA levels of autophagy related genes such as ATG4b, ATG7, ATG14, and LC3B. Interestingly there is no differences observed in the lysosomal marker genes by qPCR and protein expression by western blot. Immunostaining from RFP-GFP-LC3 mice demonstrates enhanced autophagosome formation suggesting impaired autophagy flux in the alcohol fed animals. Beta catenin, one of the key regulator proteins for maintenance and differentiation of intestinal stem cell is reduced in both crypts and whole tissue. Immunostaining of WT animal suggested colocalization of beta catenin with LC3B suggesting beta catenin is marked for lysosomal degradation. The levels of the epithelial cell specific and lineage marker genes such as LYZ1, LYZ2, MUC2 and SOX9, MATH1, KLF4, SPDEF were also increased in these animals as assessed by qPCR. Reduced beta catenin levels increased secretory cell lineage markers and increased autophagosome formation suggesting alcohol favors more secretory cell in the gut tissue. Our findings also suggest that autophagy deficiency exacerbates alcohol-associated liver injury.

Title: Comparing acid functionalization methods of HIPS for mineral precipitation in porous media fabrication

Primary Author: Nailah Braziel Ibna Kenyatta

Additional Authors: Lauren Beckingham;Harrish Kumar Senthil Kumar;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Mineral precipitation in porous media occurs in a range of environmental systems and is essential to long-term mineral storage of CO_2 in geologic carbon storage systems, for example. Precipitation reaction mechanisms, rates, and impacts on formation properties, however, are not well understood and challenging to assess experimentally, requiring simplified porous media to facilitate replicable experiments. Precipitation is further complicated in systems that may favor the formation of multiple mineral phases. This work explores the utility of 3D printing as an experimental approach to enhance the understanding of mineral precipitation. This work considers a mineral precipitation experiment in a continuous flow system utilizing an aqueous solution supersaturated with calcite. Using a high-impact polystyrene (HIPS) film that has been acid functionalized over the course of two days, the solution is fed through a designed DLP 3D printed 2D film holder. By expanding on the types of acid functionalization, this study explores the effects of different chemical reactions and calcite formation. The experiment analyzes mineral growth on the functionalized 2D films throughout a range of time periods. The crystal growth that results from experimenting with different concentrations and lengths of exposure is monitored and examined using X-ray diffraction. Using a 3D-printed core sample, the results will be expanded to consider mineral development in a porous environment. Overall, this study contributes to evaluating the growth kinetics of mineral precipitation and the viability of 3D printing reactive rock samples to duplicate mineral reactions inside porous structures that mimic those in natural systems.

Title: Nano-Enhanced Electrokinetic Conditioning of Expansive Soils Using MgO Nanoparticles

Primary Author: Najibullah Zulfeqar

Additional Authors: Ali Khosravi;Shiqiang Zou;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: This study investigates the application of electrokinetic nano-conditioning for stabilizing expansive soils using MgO nanoparticles (NP). Initial analysis experiments compared the effectiveness of both MgO and SiO_2 NP through physical mixing, achieving a 43.25% increase in plastic limit and a 22.78% reduction in plasticity index at a 3% concentration. Furthermore, 3% MgO nearly eliminates one-dimensional swell strain and exhibits enhanced moisture retention characteristics through soil water retention curve (SWRC) analysis. The MgO-treated soil showed increased air entry and residual suction values, particularly at higher concentrations (2% and 3%), due to the formation of hydroxy-Mg-interlayers within clay structures that reduce interlayer spacing and water accessibility, combined with pore network modification through nanoparticle void-filling of expansive soil. Subsequent electrokinetic experiments conducted at varying electric potentials (10, 15, and 25 V) revealed systematic modifications in soil properties across the treatment zone, with unconfined compressive strength reaching 175.43 kPa near the anode (190.93% increase) under 25V treatment and plasticity index reducing from 31.04% to 24.24% near the cathode, possibly due to increased electrokinetic transport rates. The combined electrokinetic-MgO treatment achieved significant improvements, including up to a 39.39% reduction in swell strain near the anode and a 221.39% increase in unconfined compressive strength near the cathode at a MgO-to-water ratio of 1:10. X-ray fluorescence analysis confirmed successful MgO distribution throughout the soil matrix.

Title: Exploring the ocean's natural pharmacy: Marine bioactives for prevention and therapy of hypertension

Primary Author: Nan Pyae Mon

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Primary hypertension is one of the most prevalent and well-studied idiopathic conditions across various healthcare disciplines globally. Pharmacological interventions such as diuretics, angiotensin converting enzyme inhibitors, angiotensin receptor antagonists (ARBs), calcium channel blockers, and beta-adrenergic antagonists have been developed to lower blood pressure effectively. However, these classic medications are often associated with moderate to severe adverse drug effects and hypersensitivity reactions. Despite the growing interest in natural-bioactives mediated remedial, the commercialization of marine bioactives for hypertension management has not been extensively explored. This study aims to investigate the current literature on marine bioactives in hypertension treatment, focusing on their potential benefits in research development and clinical trials. A comprehensive literature search was conducted using PubMed, Google Scholar, and Embase databases. Studies containing a combination of key terms such as "hypertension," "marine bioactives," and "hypertension marine bioactives" were included in the analysis. The current review suggests that marine-derived bioactives may offer effective blood pressure regulation with fewer adverse effects, potentially improving the overall quality of life. However, findings indicate that research on marine bioactives remains a small fraction of pharmacological or nutraceutical research. Additionally, the development of novel marine-based nutraceuticals/pharmaceuticals for hypertension progresses at a slower pace compared to conventional drug discovery.

Title: Storms and Rainbows: Examining Parental Aggravation and Positive Feelings in Single Motherhood

Primary Author: Nana Adjoa Konadu Attiah

Additional Authors: Adrienne Marks;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Single motherhood is complex, with mothers having a variety of experiences, support and resources. For some single mothers, parenting aggravation is more prominent when experiencing economic strain, lack of support, and psychological burden. Most studies focus on parenting stress, which is broader and encompasses the overall strain experienced by parents. However, parenting aggravation, a more specific aspect of the parenting experience, is characterized by feeling overwhelmed, dissatisfaction with parenting, and difficulty managing children's behaviors. Children's behavior can be externalizing or internalizing. This study aims to explore how specific stressors in single-mother households affect child internalizing behavior and the potential protective role of maternal emotions. Participants were 2,742 single-mother-child dyads from the United States sampled from the Future of Families and Child Wellbeing Study (FFCWS) Year 5 follow-up. Mothers ranged in age from 20 to 50 years, and child's age ranged from 57 to 72 months. Mother's parenting aggravation and mother's positive feelings towards the child were assessed. Child internalizing behaviors, such as anxiety, depression and withdrawal, were also assessed. The results from a structural equation model indicated that as single mothers have high parenting aggravation, their children tend to have lower internalizing behaviors. An increase in a mother's positive feelings towards their child is associated with a decrease in their child's internalizing behavior. Additionally, a mother's positive feelings towards their child moderates the relationship between parenting aggravation and the child's internalizing behavior, acting as a buffer between them. The results highlight the need to focus on positive feelings towards the child as a protective factor against parenting aggravation and child internalizing behavior and have implications for programs targeting single mothers to help with their parenting practices.

Title: Discovery of novel 2D materials from high-throughput computational etching of experimentally known compounds

Primary Author: Nana Kwasi Nkansa Tweneboah

Additional Authors: Valentina Nesterova;

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: There is a great need for 2D materials and their extraordinary properties. Most of these materials discovered so far are synthesized from 3D Van Der Waals crystals. However, the small number of such parenting structures limits the discovery of novel ones. Another option is the selective electrochemical etching of 3D layered structures with intercalated atoms. Thus, this project seeks to find, among existing stable crystal structures, the ones that are layered and contain weakly bonded atoms that can be etched selectively. This was inspired by the work of Cheon et al. First, 144,191 stable material structures are drawn from the Materials Project database with the MPRester Python library. Next, the resulting data was screened for their dimensionalities with different tolerance factors. This was done by implementing the open-source algorithm developed by Cheon et al., modified to return the types of intercalated atoms between the layers. The resulting structures were analyzed to determine the proportion of layered 3D structures present that are suitable candidates for selective electrochemical etching. We also provide statistics about the interlayer atomic species to suggest etching agents for 2D material creation. Searches were conducted utilizing the AU Easley high-performance computer accessed through a Linux-based terminal. This dataset can be next used for Density Functional Theory calculations to evaluate exfoliation energies and define 3D structures that can be etched, which will lead to the creation of a database with prospective parenting materials for novel 2D materials. This database can then serve as the basis for future research into 2D materials.

Title: Co-Infection of Nile Tilapia with Strep Species

Primary Author: Natalie Johnson

Additional Authors: Timothy Bruce;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Aquaculture is rapidly expanding in the United States, generating millions of dollars in revenue annually. However, this industry can be devastated by bacterial and viral pathogens, limiting growth within this agricultural sector. Specifically, producers of Nile tilapia (Oreochromis niloticus) face disease concerns with Streptococcus agalactiae and S. iniae. These pathogenic bacteria can rapidly infect cultured tilapia populations and result in considerable production losses. The Streptococcus spp. are a gram-positive, cocci-shaped bacterium that can cause ulcers, skin hemorrhaging, spiral swimming behavior, and anorexia in a fish 48 h post-exposure or even sudden, asymptomatic mortality. Relatively little is known about their pathogenic mechanisms, and no approved commercial vaccines are currently available to help prevent these infections. Thus, antibiotics are frequently the common treatment route. This current project aims to characterize how these two bacteria function in a co-infective nature in vitro by using the Cerillo Co-Culture system and analyzing the bacterial growth dynamics. The study of co-infections is a little-understood area of research, and more studies are needed on the host-pathogen and pathogen-pathogen interactions. Following the evaluation of growth dynamics in a mixed culture, we determined that growing S. agalactiae and S. iniae together increases the growth rate of both species compared to separately grown monocultures. This suggests that in a co-infection of both species, the infection may establish itself more quickly than in a singular infection, potentially causing a more severe infection. To further investigate how co-infections can impact the virulence of a disease, we will perform proteomic sampling over 24 hours, analyzing the concentration of secreted proteins and the protein concentration inside the cells. This will give us further insight into the potential virulence factors secreted and how that changes between how the pathogen matures in a culture by itself and in a co-culture with another virulent species.

Title: Religion on Auburn's campus and its effect on students

Primary Author: Natalie White

Additional Authors: Sara Driskell; Amy Kim; Emma Narlinger

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Religion plays an important role in shaping a person's identity and how they interact with others. In many communities, especially in the South, people tend to assume that everyone around them is Christian. Being around people that share your core values, like religion, solidifies comfort in your identity. However, the opposite is true when your religious values are in the minority. Christianity is the most commonly practiced religion in Auburn, and it affects students in many aspects of their daily lives. Therefore, it is crucial to understand how the presence of Christianity affects students' sense of belonging. The present study examined the effects of religion and religious communities on students at Auburn University. Before the study, participants completed a demographic section about their feelings of belonging on Auburn's campus, religious beliefs, and strength of religious beliefs. We also gathered students' perceptions of Auburn's religious community and how this impacted their well-being. Students were then randomly assigned to examine two different articles imitating The Auburn Plainsmen (local college newspaper) about religion on campus. One group was presented with an article that aligned with Christianity, while the other group was shown an article that opposes the majority religious belief and demonstrates religious diversity on campus. These articles act as our independent variables. The dependent variables are students' reactions to these articles and their feelings of belonging. We hypothesize that students who identify as religious minorities will a) experience less sense of belonging on Auburn's campus and will b) react positively to the article that demonstrates religious diversity on campus. This study will reveal the effect a dominant religion has on majority and minority group members and is crucial for understanding how students can feel more accepted in regards to their religion.

Title: Evaluating the impact of orexin receptor agonists on behavioral and cognitive symptoms in narcoleptic Orexin Knock-Out (OXKO) mice

Primary Author: Natasha Wendy Grabau

Additional Authors: Eva Ortiz-Feder;Julia Peterson;Henry Limbo;Vander LeKites;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Narcolepsy is a sleeping disorder resulting from the loss of orexin neurons in the lateral hypothalamus and the consequent loss of orexin signaling in the brain. Narcolepsy patients typically exhibit severe sleepiness during the day, fragmented sleep during the night, and cataplexy which are considered as primary symptoms. Orexin knock-out (OXKO) mice are a model system for Narcolepsy and previous research demonstrated that an orexin agonist targeting the orexin 2 receptor (OX2R) can be used as an effective treatment for the primary symptoms of narcolepsy, but did not investigate the secondary symptoms (memory impairment, anxiety, and depression). We tested whether an OX2R agonist could alleviate the secondary symptoms in OXKO mice. To assess the efficacy of our agonist, we used three groups of OXKO and WT mice. Each group received either the OX2R agonist, a vehicle or Modafinil, a current narcolepsy drug. Following administration, we assessed performance in the Novel Object Recognition (NOR) test (memory), Open Field Test (OFT; anxiety), and Forced Swim Test (FST; depression). The NOR test was used to assess working, short-term, and long-term memory. The OFT was used to measure the percent time mice spend exploring the center zone of an open arena. A less anxious mouse would spend more time exploring compared to a more anxious mouse that would spend more time immobile. Higher time spent swimming in the FST indicates less depression-like symptoms. Although not significant, there was a trend for agonist treated OXKO mice to spend less time in the center zone of the OFT arena suggesting an increase in anxiety-like behavior after agonist administration. Assessment of working memory in the NOR indicated a trend towards agonist treated OXKO mice to perform better. In the FST, both agonist and Modafinil treated OXKO mice spent more time swimming suggesting that both these drugs may reduce depression-like symptoms in the OXKO mice. Our results show that the OXR2 agonist may improve working memory and decrease depression-like symptoms, but it may increase anxious behavior in OXKO mice.

Title: Generation and Characterization of Canine Tumor-Associated Macrophages

Primary Author: Nathan Newman

Additional Authors: Jonathan Marable;Alana Kramer;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Cancer immunotherapy utilizes the patient's immune system to target cancer cells. However, cancer cells often induce an immunosuppressive tumor microenvironment (TME) that helps them avoid detection and subsequent targeting by the body's immune system. One such mechanism is recruiting M2 macrophages to the site of the malignancy. There are two broad types of macrophages, namely M1 (pro-inflammatory) and M2 (anti-inflammatory). M2 macrophages dampen the antitumor immune response by releasing cytokines and growth factors to inhibit the function of cytotoxic T cells and natural killer (NK) cells. In contrast, M1 macrophages play a crucial role in recognizing and eliminating cancer cells by presenting tumor antigens to T cells, generating an effective antitumor immune response. The main goal of this study is to generate tumor-associated macrophages (TAMs) from canine monocytes and to comprehensively characterize them both functionally and phenotypically. To do this, canine peripheral blood mononuclear cells were isolated from healthy dogs, and monocytes were enriched using anti-CD14 magnetic beads via magnetic-activated cell sorting (MACS). The purified monocytes were cultured in RPMI medium supplemented with specific growth factors to differentiate into M1 (GM-CSF, IFN-γ & LPS) and M2 (M-CSF, IL-4 & IL-10) macrophages. For TAM differentiation, the monocytes were treated with tumor-conditioned media (TCM) derived from canine melanoma cells and supplemented with M-CSF, IL-4 & IL-10. The resulting M1, M2, and TAM populations were characterized based on expression of various immunomarkers, including CD14, CD206, MHCII, CD163, CD80, and CD86. Additionally, gene expression profiles were assessed through qPCR. By using MACS, a high purity sample of monocytes was collected. Murine, human and canine M2 and TAMs are defined by their co-expression of CD163 and CD206. Meanwhile, no such co-expression was detected on M1 macrophages. Therefore, our protocol successfully isolates and identifies canine M1, M2 and TAMs macrophages. We will evaluate the effect of CD206-targeted peptides on canine M2 and TAMs compared to M1 macrophages in the future.

Title: Encapsulation of bacteriophage within chitosan nanoparticles for delivery of pig-specific contraceptives

Primary Author: Nathaniel Pike

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Free-ranging populations of wild pigs are a significant problem across the United States and other developed counties. Damages are estimated at ~$1.5 billion per year in the United States. Immunocontraceptives are proposed as a means to manage the wild pig population. No efficient delivery system is available for administration of species-specific, needle free vaccines in a multi-species field environment. Bacteriophages have been engineered to display species-specific peptides stimulating production of anti-sperm antibodies. This study attempts to address that challenge by developing chitosan encapsulated bacteriophage particles for oral delivery. Here we sought to determine the size and shape of these particles and the effectiveness of encapsulation. Chitosan nanoparticles were created using an ionic gelation method using sodium tripolyphosphate (STPP) as a crosslinker. Nanoparticles were formed by the addition of sodium tripolyphosphate to a chitosan solution with stirring at 150 rpm. Particles containing phages were prepared using the same conditions and diluting phages into the chitosan mixture. Following particle formation, aggregates were removed by centrifugation. Nanoparticles were characterized for their size and encapsulation efficiency. Encapsulation efficiency was calculated as the recovery of phages titered after nanoparticle formation compared to the total input. Phage encapsulated in chitosan particles were successfully prepared using the ionic gelation method using common reaction conditions as determined by an increase in sample turbidity when mixed with crosslinker. Analysis of empty nanoparticles revealed the size was approximately one micron in diameter and precipitated in solution. Addition of bacteriophages significantly decreased the particle diameter to ~150 nm. We demonstrate that nanoparticles encapsulating bacteriophages could be created by ionic gelation method and are currently being studied for their stability and release in vitro.

Title: Effect of Biochar on Methane production and Odor Reduction During Anaerobic Digestion of DAF solids collected from Poultry Slaughterhouse Facility in Alabama

Primary Author: Navid Farahmandzad

Additional Authors: Brendan Higgins;Saravanan Ramiah Shanmugam;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Throughout the poultry processing cycle, a significant amount of wastewater containing proteins and fats is generated. Dissolved Air Flotation (DAF) is the commonly utilized method for separating solid components (fats and proteins) from this wastewater. The resulting DAF solids, originating from poultry slaughterhouses, consist of approximately 50-60% lipids and 15-25% proteins on a dry matter basis. Currently, these DAF solids, found across the U.S. and including Alabama, are applied to land, causing nuisance odors in the community and acting as a potential vector for pathogens. Batch test reactors have been designed to demonstrate the viability of generating methane through anaerobic digestion (AD) to harness the energy potential of DAF solids. In order to increase methane production and reduce pH drop after DAF addition, inoculum has been adapted to DAF solid samples. However, a significant challenge in the AD process is the emission of highly malodorous compounds, leading to community resistance against the installation of anaerobic digesters for treating poultry-derived waste (DAF solids). Analysis using headspace-gas chromatography-mass spectrometry (HS-GC-MS) revealed the presence of malodorous compounds in biogas, including methanethiol, dimethyl disulfide, dimethyl sulfide, and dimethyl trisulfide in samples following the AD of DAF solids. These compounds not only generate an unbearable odor posing health risks to humans but also compromise biomethane purity, hindering biomethane production. Therefore, alongside biogas assessment, it is crucial to address odor mitigation during the anaerobic digestion of DAF solids. However, there is a lack of literature on odor abatement in anaerobic digestion processes. Previous studies have indicated that conductive materials like biochar can increase methane production by enhancing the activity of methanogens. The main objective of this study is to explore the potential of pine wood biochar, generated through the pyrolysis of waste pine wood under low oxygen conditions, to mitigate odor in AD and increase methane production. This investigation focuses on two primary aspects: first, the examination of two types of pine wood biochar in reducing odor during AD, and second, the evaluation of biochar's impact on enhancing methane production and purity in the final biogas. Additionally, ion chromatography will be performed to assess the effect of the noted biochars on the anion and cation profile, indicating the nutritional value of digestate that can be utilized as agricultural compost or nutrients for algae cultivation. Keywords: DAF solids, Poultry Slaughterhouse solid waste, anaerobic digestion, odor analysis, dimethyl disulfide, semi-continuous anaerobic digestion, biochar

Title: Effects of Nanotube Type and Mixing Method on the Dispersion of Carbon Nanotubes in Epoxy Resin

Primary Author: Negin Moaseri

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Carbon nanotube (CNT) epoxy nanocomposites are widely used in the aerospace industry and other fields, due to their excellent mechanical, thermal, and electrical properties. However, the strong van der Waals forces between the nanotubes often lead to aggregation, which decreases nanocomposite performance. Thus, understanding the dispersion of carbon nanotubes within the epoxy matrix is critical to enhancing material properties. Here, we compare the effects of ultrasonication and high shear mixing on the dispersion of multi-wall carbon nanotubes (MWCNTs) in the epoxy resin. Optical microscopy and rheology were used to visualize and quantify differences between dispersions prepared by different methods. For poorly dispersed MWCNTs, the dispersions were Newtonian well above the theoretical concentration needed for the formation of a percolated network of MWCNTs. For other dispersions, rheology was used to determine the percolation threshold and understand flocculation behavior through fractal analysis. In addition, fitting the steady shear rheology data to the Carreau-Yasuda model enabled quantifying the effects of MWCNT dispersion on nanocomposite flow behavior. These results highlight the value of rheological methods in understanding nanomaterial dispersions.

Title: Predator and prey density impacts larval performance of largemouth bass in an indoor recirculating aquaculture system

Primary Author: Nelson Sharma Parajuli

Additional Authors: Anita Kelly;Timothy Bruce;Luke Roy;Kyle Wood;Kaylan Martin;Ian Butts;Anneleen Swanepoel;Samitha Liyanage;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Proper transitioning from endogenous to exogenous feeding is pivotal for the early rearing success of aquaculture species. While some species can successfully be raised on artificial diets (i.e., commercial) from first feeding, the largemouth bass (LMB) requires a co-feeding period of both live prey and artificial diet. At present, information regarding early feeding strategies for LMB are limited. Our objective was to determine how initial yolk-sac fry stocking density, prey density, and the stocking density × prey density interaction impact LMB growth and survival. At peak hatch, yolk-size fry were stocked (~27°C) in 25 L tanks equipped with recirculation aquaculture system (RAS) technology at densities of 25, 50, and 100 yolk-sac fry/L. Starting at 3 days post-hatch (DPH), fry from each density were factorially fed Artemia at 2, 4, and 8 Artemia/mL every 2-3 h from 07:00 to 23:00. In addition, all treatments received rotifers from 3-8 DPH. Mortalities and excess feed were removed daily. Rearing occurred under a 12-h light/12-h dark photoperiod. Fish were randomly sampled weekly from 3-27 DPH for industry-relevant offspring morphometrics and performance traits. To further understand phenotypic sensitivity to predator (fish) and prey density, we are currently following expression of genes associated with stress tolerance, growth, and development. Preliminary results indicate that initial yolk-sac fry stocking density, prey density, and the stocking density × prey density interaction impacted offspring traits during this critical early life period. Highest survival and specific growth rate were 90.3 ± 4.1% and 2.98 ± 0.1, respectively when fry were initially stocked at 25 fry/L and fed 8 Artemia/mL. Highest tank biomass at 28 DPH was 199.5 ± 5.6 g for the 100 fry/L and 8 Artemia/mL treatment. Our results provide the aquaculture sector with greater knowledge and technological innovation to enhance hatchery production efficiency for this important food-fish.

Title: Design and development of novel LXR agonists using AI technology to modulate cofactor recruitment in diabetes and NAFLD

Primary Author: Nicholas Crall

Additional Authors: Meenakshi Singh;Fajar Setyo Wibowo;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Liver X receptor (LXR) is a nuclear transcription factor that regulates the transport and metabolism of cholesterol, which is centrally located in the paradigm of APOE dysregulation and cholesterol in the HDL form. Formerly, LXR agonists were developed to target gene transcription regulating cholesterol efflux transport proteins ABCA1. However, LXR agonists have been observed to induce steatosis and neutropenia in humans and thus have failed at the clinical level for atherosclerosis. LXR exists as two isoforms, LXRa, expressed highest in the liver, macrophages, lungs, and kidneys, while LXRb is more abundant in the brain. We have discovered novel LXR agonists for LXRb from a high throughput virtual screen (HTVS) to stabilize the His435-Trp457 activation switch in the activation function domain (AF-2). Artificial intelligence models demonstrate a safer ADME profile decreasing side effects while improving cholesterol modulation towards DM and NAFLD pathology. Schrodinger suite, bioluminate, was used to perform protein-protein docking studies and HTVS in Maestro. Molecular dynamic (MD) simulations were run in Schrodinger to study the stability of cofactors in the binding site when influenced by HTS ligands. Luciferase assays were conducted to determine agonist activity in LXR. SwissADME predicted compound properties and toxicity profiles. Our preliminary data in-silico has determined that our novel compounds serve as LXR agonists. Compounds developed in-silico have proven to influence cofactor recruitment and stability of helix-12 compared to control compounds. Statistical tests were then performed to measure MD simulation accuracy. Lastly, we have observed a significant bias toward LXRb, indicating that compounds developed are viable in DM and NAFLD while avoiding steatosis, neutropenia, and atherosclerosis. Further work will focus on cofactor recruitment for measuring LXR gene profile changes that regulate cholesterol ester formation, storage, and metabolism.

Title: ArAre Monoclonal Antibodies Against ERBB2 Effective Against ERBB2- and ERBB4-Dependent BRAF-WT Melanoma Cell Lines?

Primary Author: Nicholas DeFeo

Additional Authors: David Riese;Haram Kim;Teigen Nelson;Tate Reese;Allie Pegel;Charleigh Gumapac;Markelle Scott;Ella Wilson;Tori Huffman;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Melanomas are aggressive and deadly types of skin cancer resulting from genetic mutations. About 50% of melanomas harbor a gain-of-function mutation in a BRAF allele, and these tumors respond to immune checkpoint inhibitors (ICIs) or a combination of BRAF and MEK inhibitors. Unfortunately, the other 50% of melanomas that possess wild-type BRAF alleles (BRAF-WT melanomas) are not responsive to targeted therapies, and ICIs are not highly effective against these tumors. Thus, our long-term goal is the development of agents that are effective against BRAF-WT melanomas to decrease patient mortality. Following up on in silico analyses of tumor genome datasets, we have demonstrated that ERBB4 is sufficient and necessary for the proliferation of four BRAF-WT melanoma cell lines. ERBB4 encodes a receptor tyrosine kinase 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. Since ERBB4 homodimers inhibit tumor cell proliferation, we hypothesize that ERBB4-ERBB2 heterodimers drive these ERBB4- and ERBB2-dependent, BRAF-WT melanoma cell lines. To test this hypothesis, we have developed strategies for propagating the hybridomas that produce the ERBB2 monoclonal antibodies 4D5 (precursor of the FDA-approved drug trastuzumab) and 2C4 (precursor of the FDA-approved drug pertuzumab). We are developing strategies for concentrating, purifying, and quantifying 4D5 and 2C4. Future experiments will determine whether 4D5 or 2C4 inhibits the proliferation of ERBB4- and ERBB2-dependent, BRAF-WT melanoma cell lines. Since 4D5 blocks ERBB2 homodimerization, whereas 2C4 blocks ERBB2 heterodimerization, the results of these experiments may shed mechanistic insights into the mechanism of ERBB2 and ERBB4 action in ERBB4- and ERBB2-dependent, BRAF-WT melanoma cell lines. Moreover, positive results could speed the translation of pertuzumab or trastuzumab into clinical practice.

Title: An evaluation of machine learning and Bayesian-based frameworks for forest aboveground biomass mapping and uncertainty quantification using airborne lidar and PlanetScope

Primary Author: Nisham Thapa

Additional Authors: Basanta Shrestha;Tamara Milton;Heather Alexander;Lana Narine;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Approximately 75% of Alabama's land is forested, making it one of the largest carbon sinks in the United States (US). Forest Aboveground Biomass (AGB) estimation is essential for understanding forest carbon dynamics and informs strategies for monitoring, reporting, and verifying forest carbon stocks. Free and open access to airborne lidar and PlanetScope imagery enables fine-scale AGB estimation and monitoring. However, utilizing these data to estimate AGB in the southern US mixed forests still presents challenges to achieving spatially comprehensive estimates. The study aimed to identify the best modeling framework for deriving accurate, fine-scale AGB estimates in fire-managed mixed forests ranging from 13.5 to 733 km^2. We evaluated two modeling techniques, five variable selection methods, and compared a generalized AGB modeling approach with site-specific approaches across the study sites. The RF-based framework outperformed the Bayesian-based framework across most sites, although the Bayesian framework with RFE excelled in a site having smaller samples ($n = 15$). The most important predictors included lidar-derived canopy height and density. The generalized model achieved an optimal R^2 of 0.46, while ecoregion-specific models yielded R^2 values ranging from 0.29 to 0.70. We recommend creating ecoregion-specific AGB models using regionally selected predictors for better accuracy. Our framework produces high-resolution (20 m) AGB maps that reflect site-specific conditions, providing valuable information for validating spaceborne products and enhancing AGB monitoring.

Title: Exploring space biology through seed germination of palmer amaranth and morning glory under simulated lunar and martian conditions

Primary Author: Nisith Nishank Purohit

Additional Authors: Aniruddha Maity;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Scientists have been investigating the cultivation of plants under simulated extraterrestrial conditions, facing numerous challenges such as anhydrous, anoxic environments, galactic cosmic radiation, and altered magnetic fields, gravity, and soil characteristics found on celestial bodies like the Moon and Mars. Identifying hardy plant species capable of surviving these harsh conditions is crucial for sustaining long-term human space exploration. Amaranthus palmeri (Palmer amaranth) and Ipomoea spp. (morning glory) are of particular interest due to their demonstrated ability to thrive in extreme environmental conditions on Earth, suggesting they may be suitable for space cultivation. To test this, seeds of both species were exposed to magnetic fields simulating those of the Moon (ranging from 6 nT to 313 nT) and Mars (ranging from 1 µT to 1.5 µT), in addition to terrestrial magnetic field variations (0 µT, 15 µT, 50 µT, 100 µT, and 150 µT), created using a 3D Helmholtz coil. Additionally, the seeds were subjected to reduced gravity conditions using a clinostat and grown in artificial soil that mimicked the lunar surface environments of the Grade Mare and Highland regions. Preliminary findings indicate that weed seeds exhibits a remarkable ability to withstand these simulated extraterrestrial conditions, suggesting it could be a promising candidate for future space agriculture on the Moon and Mars.

Title: Fridel Crafts synthesis of novel bio-lubricants from fresh and waste cooking oils: Comparison of chemical and flow properties

Primary Author: Noor Fatima

Additional Authors: Sudip Saha;Robert Jackson;Sushil Adhikari;Hossein Jahromi;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The increasing global demand for sustainable and eco-friendly alternatives to conventional lubricants has encouraged research into bio-lubricants derived from renewable sources. Mineral-based lubricants pose significant environmental concerns due to their uncontrolled discharge. At the same time, waste cooking oil (WCO) contributes to pollution and sewage system blockages, with an estimated global accumulation of 16.5 million tons. The improper disposal of WCO exacerbates ecological and human health risks, necessitating efficient utilization methods. This study uses a novel process to synthesize bio-lubricants using WCO and vegetable oil (VO) as feedstocks. This study builds on a previously developed process—comprising hydrolysis, high-temperature (HT) dehydration, Friedel-Crafts (FC) acylation, and hydrodeoxygenation (HDO)—to convert VO and WCO into a new generation of bio-lubricants. Another similar pathway was developed that uses low-temperature (LT) reactions to produce FC-based products, referred to as FC-LT bio-lubricant. The LT method has the potential to combine hydrolysis and dehydration into a single, energy-efficient step, significantly reducing energy requirements compared to the high-temperature method. The new pathways include oleyl chloride synthesis and oleic anhydride formation before FC acylation at 80°C. The synthesized bio-lubricants exhibited unique molecular architectures with long hydrocarbon chains and cyclic structures, enhancing their physicochemical properties. Four types of bio-lubricants (based on process and feedstock) were synthesized and denoted as FC-HT, VO, FC-HT-WCO, FC-LT-VO, and FC-HT-WCO. All bio-lubricants were tested for various properties such as Noack volatility, viscosity, viscosity index (VI), pour point, total acid number (TAN), and thermal stability using thermogravimetric analysis (TGA). Scattered characteristic properties of bio-lubricants were observed. FC-LT-VO showed the highest thermal stability among all. BL-LT-WCO demonstrated good range of Noack volatility than FC-HT-WCO while BL-HT-WCO indicated a lower TAN than BL-LT-WCO. Similarly, FC-HT-VO with pour point exhibited superior low-temperature fluidity compared to FC-LT-VO. The suite of bio-lubricants suggests that WCO and VO could be good candidates for bio-lubricant synthesis.

Title: Safe Space at Auburn

Primary Author: Nora Heeney

Additional Authors: Morgan Yordy;

Department/Program: Nursing

College: College of Nursing

Abstract: Experiencing multiple psychosocial stressors such as academic performance pressure, time-management challenges, and work-life balance demands, many nursing students are susceptible to high stress levels. A nursing student's inability to process stressors can cause issues in a future workplace where the nurse must manage multiple needs. Different methods have been conducted to identify ways to develop stress management skills, including having a designated area for stressor identification and relief. The purpose of Safe Space at Auburn is to determine whether a room created for stress management allows students to recognize stressors and develop techniques to manage them. Safe Space at Auburn contains evidence-based tools for stress reduction, such as dim lighting, cushioned furniture, a pleasant aroma, weighted objects, and guided relaxation posters. To measure the efficacy of how the space impacts stress management, third and fourth-semester nursing students at Auburn University College of Nursing will have access to the space and its tools. It is anticipated that students will most often use the room on test days, clinical simulation practices, and quiz days. Before entering the room, students will rate their level of stress using the Subjective Unit of Distress Scale (SUDS). Multiple activities will be provided, such as silent reflection, journaling, sensory modulation, and muscle relaxation. They will then use SUDS to rate their stress level after using the room. The expected outcome of the project is that students will have a decreased stress level compared to those who do not utilize this resource, and they will learn strategies to process stress that they can apply to future situations. Transitioning into the workspace, it's essential for nurses to develop skills to manage their emotions as indicators of well-being, rather than a compass for their actions. This self-awareness allows nurses to advocate for their patients while also prioritizing their own well-being.

Title: Effects of heterogeneity in reactive transport models for carbon sequestration in the Tuscaloosa Group, southwest Alabama.

Primary Author: Nora Rivera

Additional Authors:

Department/Program: Geology and Geography

College: College of Sciences and Mathematics

Abstract: Anthropogenic CO2 continuously increases due to the burning of fossil fuels and everyday human activities. In order to mitigate the adverse effects of greenhouse gases, it is essential to apply techniques that remove excessive CO2 from our atmosphere. Carbon capture and storage applications have successfully shown that large amounts of CO2 can be permanently stored in the long term. Geological carbon sequestration is when CO2 is stored in porous rock formations after being captured from energy or industrial sources. When CO2 is injected into these porous formations, many geochemical reactions could occur, affecting key formation properties such as porosity and permeability. Therefore, it is crucial to predict and understand, at best, some of these possible reactions. Reactive transport modeling is an excellent tool for evaluating possible geochemical reactions during CO2 injection. These models use formation data such as mineralogy, porosity, brine composition, and formation conditions such as temperature and pressure. Many of these studies simplify modeling parameters and assume the same physical properties for the entire formation. However, sedimentary formations are complex and vary in porosity and mineralogy, which are crucial for carbon sequestration. In this study, samples collected from the Tuscaloosa Group in southwest Alabama are analyzed and used to build a reactive transport model to evaluate the formation's feasibility and understand the role of heterogeneity in reactive transport modeling. A series of 12 modeling simulations were built with CrunchFlow, where 11 of these simulations consisted of accurate sample data, while one simulation was built using averaged data to compare modeling results, which include ion concentrations, pH, mineral volumes and porosity. 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 the Southern States Energy Board. Petrographic, X-ray diffraction (XRD), and core analyses were done by Schlumberger Reservoir Laboratories to understand the samples' porosity, permeability, and mineralogical composition.

Title: Inclusion complexes of posaconazole with hydroxypropyl- and sulfobutylether-β-cyclodextrins for intravenous injections: Formulation and stability studies

Primary Author: Nur Mita

Additional Authors: Oladiran Fasina;Jayachandra Ramapuram;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Posaconazole, an antifungal drug, is essential for treating invasive fungal infections, particularly in immunocompromised individuals. However, its clinical effectiveness is limited by its poor aqueous solubility and pH-dependent solubility, requiring intravenous (IV) formulations for consistent drug delivery. Cyclodextrins are used to improve solubility and stability by forming inclusion complexes with hydrophobic drugs. This study aimed to evaluate the inclusion complexes of posaconazole with hydroxypropyl-β-cyclodextrin (HPβCD) and sulfobutylether-β-cyclodextrin (SBEβCD), assessing their solubility, stability, and suitability for IV injections. Inclusion complexes were prepared and characterized in both liquid and solid states, with phase solubility studies comparing complexes with and without pH adjustment. Solid-state analyses using Fourier Transform Infrared spectroscopy (FTIR) and Differential Scanning Calorimetry (DSC) revealed changes in the crystalline structure of posaconazole when complexed with βCDs. A posaconazole IV injection using HPβCD was formulated and compared with an FDA-approved SBEβCD formulation. The two formulations were evaluated for visual appearance, pH, osmolality, drug recovery, and stability. The phase solubility study indicated that HPβCD at pH 2.6 had the highest solubilizing capacity. DSC and FTIR analyses showed increased amorphization and interactions in freeze-dried complexes, enhancing solubility and stability. A validated HPLC method demonstrated excellent linearity, precision, and stability for analyzing posaconazole in IV injections. Both formulations showed clear solutions with a pH of 2.6, though SBEβCD resulted in a hypertonic solution with higher osmolality. Stability tests at 40°C, room temperature, and 4°C over 3 months showed that both formulations maintained clarity and acceptable pH, with drug recovery above 90%. In conclusion, an HPβCD-based posaconazole IV injection formulation was successfully developed with improved solubility, osmolality, and stability compared to the SBEβCD formulation.

Title: Microfibrillated cellulose and biochar biocomposite development for horticulture applications

hPrimary Author: Omolola Kafi

Additional Authors: Sushil Adhikari;Rachel Day;Fatimatu Bello;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Horticulture is highly dependent on plant pots to provide controlled environments for seedlings and plant propagation often requiring direct transfer into the soil. Petroleum-based plastic pots have been widely used; however, these plastic pots are an environmental nuisance as they are synthesized from fossil sources and do not biodegrade. Furthermore, their disposal at end-use is challenging since they are rarely recycled due to the high levels of contamination with soil. There has been a huge shift to biopolymers which have the advantage of being biodegradable and more sustainable compared to their plastic counterparts. Yet, many of these biodegradable pots are structurally inferior with properties that are not as comparable to plastic pots. This research aims to formulate biocomposites with comparable properties using wood fibers, lignin-containing microfibers (LCMF), and biochar made from downed timber with polyvinyl alcohol (PVA) as a binder. For the methodology, the biopolymers were mixed at optimized formulations to obtain a homogenous mixture, oven-dried at 70oC, and compression molded at 130°C at a pressure of 500 psi for 6 minutes. The mechanical properties and dimensional stability in wet conditions were the key metrics to evaluate the performance of each formulation. Mechanical properties including the tensile strength, elongation at break, and modulus of elasticity of the samples were determined using an Instron machine which provided information on the durability and robustness of the samples under tension. Water absorption tests were performed to evaluate moisture resistance which is crucial in horticultural container applications where exposure to water is frequent. The findings from this study will determine the strategic formulation of fibers, LCMF, PVA, and biochar that will give properties suitable for horticulture applications.

Title: Sexual dimorphism of fetal and placental weights of rat fetuses exposed to prenatal cannabinoids

Primary Author: Paige Drotos

Additional Authors: Rachel West;Miranda Reed;Adrian Courville;Cristine Camp;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: As general attitudes towards recreational cannabis use have become more accepting, the prevalence of cannabis use during pregnancy has sharply increased. In this study, we tested the hypothesis that prenatal cannabinoid exposure affects fetal and placental development. We assessed the effects of inhalation of delta-9 tetrahydrocannabinol (THC) throughout pregnancy using a rat model. Starting on gestational day (GD) 5, dams received a daily vaporized dose of 100 mg/mL (THC) or polyethylene glycol (PEG). On GD19, dams were sacrificed and 88 (49 PEG and 39 THC) fetuses and placentas collected and weighed. We also isolated DNA from tail snips and used PCR to determine genetic sex by amplifying Ddx3x (found on the X chromosome) and Ddx3y (found on the Y chromosome). Weights were organized by sex and assessed using a two-way ANOVA followed by a Tukey's multiple comparison test. The average weight of the THC fetuses was significantly heavier than the PEG fetuses ($p<0.001$). The average weight of the THC placentas was also higher than the PEG placentas ($p<0.05$). Interestingly, when biological sex was used as a variable, only the THC male fetuses were significantly larger than the controls (PEG male vs THC male $p<0.05$, PEG female vs THC male $p<0.01$). We saw the same phenomenon when re-analyzing the placental weights. The weight of the THC female placentas was significantly ($p<0.05$) higher than the placental weight of the PEG male pups and slightly higher, albeit not significantly ($p<0.079$) compared to the PEG female placentas. In this study, we demonstrated that prenatal cannabinoid exposure affects the growth of the fetus and placenta in a sexually dimorphic manner. While both the fetuses and placentas of THC exposed pups were larger, the observed changes differ based on sex with male rats increasing in fetal weight and the placentas of female rats increasing in weight. Future studies will focus on assessing the differences in metabolism between THC and PEG placentas.

Title: Activation of Type VI secretion system in Xanthomonas perforans for niche adaption on tomato phyllosphere

Primary Author: Palash Ghosh

Additional Authors: Destiny Brokaw;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Type VI secretion system (T6SS) is a complex nanomolecular machine in gram-negative bacteria and majorly in present in Proteobacteria, that injects toxins or effectors into neighboring targets prokaryotic or eukaryotic cells. Performing like a crossbow, T6SS plays a crucial role in interbacterial competition, host colonization and niche adaptation. Xanthomonas perforans causes bacterial leaf spot disease on tomato (Solanum lycopersicum) and pepper (Capsicum annuum) that severely impacts crops globally. X. perforans strain AL65 have two clusters of T6SS (named as i3* and i3***) however, our understanding of T6SS in this pathosystem and its role in microbiome associated inter-bacterial competition, host and niche adaption is limited. To address these questions, we conducted a screening using a promoter-activated GFP plasmid (pPROBE) tagged with X. perforans AL65 to learn whether we observe activation of T6SS against diverse tomato phyllosphere microbiota bacterial members and against conditions such as pH, salinity, antibiotics etc. Our results identified certain phyllosphere residents whose interaction with X. perforans AL65 led to activation of T6SS clusters. We also evaluated T6SS activation in response to various environmental stresses and antibiotics. We also observed a constant activation of T6SS without any external stimuli whether it is biotic or abiotic stress. Our findings highlight how the T6SS of X. perforans AL65 remain vigilant and defensive to overcome any stresses such as tomato phyllosphere isolates and also helps the pathogen's survival under diverse environmental conditions during epiphytic colonization which may provide competitive advantage in disease progression.

Title: Antimicrobial resistance in the different stages of commercial poultry production environment

Primary Author: Pankaj Prakash Gaonkar

Additional Authors: Laura Huber;Ken Macklin;Matthew Bailey;Yagya Adhikari;Courtney Higgins;Alyssa Lambert;Reed Golden;Alinne Lima Rodrigues Santana Pereira;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Antimicrobial resistance (AMR) is a threat to the poultry industry, resulting in economic losses. AMR transmission can occur between poultry, humans, and the environment, yet environmental AMR remains understudied. Our study aimed to determine AMR in the environment in different stages of commercial poultry farms. We included commercial poultry farms (n=29) in different stages of production practicing restricted antimicrobial use. Litter samples from inside and soil samples from outside the poultry house were collected. Carcass rinses were collected from the processing plant at post-pick and post-chill stages. The frequency of 3 mobile genetic elements (MGEs) and 14 antimicrobial resistance genes (ARGs) was assessed using qPCR. Shotgun metagenomics was performed on litter and soil to examine microbiome and resistome compositions. AMR to majority of antimicrobial classes was found in litter samples, and it was higher in broiler compared to breeder and pullet farms. AMR was lower in soil compared to litter and there was no difference among farm types. MGEs were most frequently found in litter and were consistent across the farm types. In the processing plant, AMR was comparable between post-pick and post-chill stages. Distinct microbial and resistome composition was observed between litter and soil. Pullet and breeder had similar profiles, while broiler had distinct microbial and resistome compositions compared with other farm-types. Litter microbiome and resistome shifted along the production chain, with increased frequency of Staphylococcus and bacitracin resistance in broiler farms. Two broiler farms had soil composition similar to litter, indicating possible AMR contamination between inside and outside poultry houses. Restricted AMU alone does not prevent AMR persistence in poultry production environments. Understanding AMR spread in the environment is essential to maintain poultry, human, and environmental health.

Title: Unraveling APE1's Affinity for G-Quadruplex DNA: Insights from Single-Molecule Imaging

Primary Author: Parker Ensminger

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Apurinic/apyrimidinic endonuclease 1 (APE1) is a multifunctional enzyme critical to DNA base excision repair (BER) and redox regulation, with possible implications in cancer progression. Recent studies suggest that APE1 interacts with G-quadruplex (G4) structures—non-canonical secondary DNA motifs implicated in genome stability and transcriptional regulation—yet the nature of this interaction remains unclear. Using Atomic Force Microscopy (AFM), we aim to visualize and characterize APE1 binding to G4-containing DNA at the single-molecule level. AFM provides high-resolution topographical imaging, allowing us to assess APE1-induced structural changes in G4 DNA and elucidate potential mechanisms of recognition and processing. Preliminary data suggest that APE1 exhibits preferential binding to G4 structures, potentially modulating their stability. Understanding this interaction could shed light on APE1's broader role in genome maintenance and its implications in cancer biology.

Title: Optimizing the Electrode Geometry of an In-Plane Unimorph Piezoelectric Microactuator for Maximum Deflection

Primary Author: Parker Megginson

Additional Authors:

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: Piezoelectric microactuators have been widely used for actuation, sensing, and energy harvesting. While out-of-plane piezoelectric configurations are well established, both in-plane deflection and asymmetric electrode placement have been underexplored in terms of actuation efficiency. This study explores the impact of asymmetric electrode geometry on the performance of slender unimorph actuators that deflect in-plane, where actuator length is much larger than width or thickness. After validating the finite element modeling method against experimental data, the geometric parameters of the proposed unimorph model are manipulated to explore the effect of different electrode geometries and layer thicknesses on actuation efficiency. Four key findings were that (1) the fringing field within the piezoelectric material plays a measurable role in performance, (2) symmetry in electrode placement is generally nonoptimal, (3) optimal electrode geometry is independent of scale, and (4) the smaller the ratio of width to thickness, the larger the deflection. The findings contribute to the development of efficient design strategies that optimize the performance of planar actuators for potential implications for microelectromechanical systems (MEMS). To aid designers of piezoelectric unimorph actuators in determining the optimal electrode geometry, three types of parameterized figures and two types of simulation apps are provided.

Title: Optimizing hormone therapy for spawning channel catfish, Ictalurus punctatus

Primary Author: Parker Rae Menefee

Additional Authors: Rex Dunham;Ian Butts;Hamza Dilawar;Darshika Udari Hettiarachchi;Ahmed Elewa Shaaban;Baofeng Su;Nadeen Abdo;Dhanuka Bambaranda Hewage;Misha Soman;Kate Pottle;Mei Shang;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: The primary goal was to increase the ovulation and hatch rates of channel catfish (Ictalurus punctatus) gene edited for reproductive genes that had received hormone therapy to restore fertility. Genetic types included luteinizing hormone (lh), follicle-stimulating hormone (fsh), and melanocortin 4 receptor (mc4r) gene edited channel catfish as well as desaturase (desat), and cathelicidin (cath) transgenic channel catfish. Hormones treatments were as follows: luteinizing hormone releasing hormone analogue (LHRHa), human chorionic gonadotropin (HCG) and equine chorionic gonadotropin (ECG) injections, as well as LHRHa implants. The lh channel catfish injected with LHRHa at 50 µg/kg body weight and1,600 IU HCG/kg body weight produced the highest hatch rate at 20.8% followed by cath (15.2%), fsh (12.5%) and desat (9.7%). The genetic and hormone combination of cath with LHRHa implant and injected with 1,600 IU HCG/kg body weight (BW) gave the highest ovulation rate at 77.8%, along with producing the highest eggs/kg BW 15,795. This combination almost produced the highest fry/kg BW, which was 52 fry/kg less than desat channel catfish implanted with 80 µg of LHRHa/kg body weight along with an injection of 1,600 IU HCG/kg BW, which produced 1,875 fry/kg BW. Life history measurements of the fry were recorded from each treatment: total length (TL), notochord length (NL), and eye diameter (ED/TL). Desat injected with LHRHa implant 80 with 1,600 IU HCG had a significantly ($P< 0.05$) higher TL (4.5 ± 0.7cm), NL (0.8 ± 0.01cm), and ED/TL (0.07 ± 0.01cm). Genetic type and hormone treatment both affected reproductive and early life history traits of channel catfish. Hormone treatments will be further optimized in future research.

Title: Understanding barriers to agricultural technology adoption: evidence from U.S. agribusiness firms

Primary Author: Pathmanathan Sivashankar

Additional Authors: Samir Huseynov;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Agricultural innovation plays a pivotal role in achieving sustainable development goals by improving crop productivity, enhancing animal husbandry, and fostering the overall well-being of communities, contributing to broader social change. This study examines the barriers to technology adoption in agricultural enterprises, focusing on agribusiness firms in the United States by using a perception-based survey and probit model estimations. The findings provide valuable insights for agribusiness enterprises and policymakers, particularly those in the U.S. and countries with similar agricultural systems. Economic barriers emerged as the primary obstacle to technology adoption, highlighting a critical trade-off between the costs of adopting new technologies and the potential profits. As these advancements are integrated into agricultural systems, they become crucial drivers in fostering environmental, economic, and social sustainability. Environmental factors also influence firms' innovation efforts, often due to regulatory requirements and standards that must be met. Notably, firms in natural resources, forestry, and fishing sectors are more inclined towards innovation than those in the food industry, which may require less technological advancement.

Title: Treated but uncontrolled characterizing hypertension in a sample of 357 older adults in the southeastern United States

Primary Author: Paul Fiore

Additional Authors: Drew Fruge;Jeanna Sewell;Jennifer Slay;Felicia Tuggle;Sarah Watts;Kelly Strickland;Laura Robinson;Rachel Helms;

Department/Program: Remote COSAM

College: College of Sciences and Mathematics

Abstract: Hypertension (HTN) continues to be a leading cause of death and disability in older adults, especially in the southeastern United States. A cross-sectional study was conducted to evaluate the relationships among measured, diagnosed, and treated HTN in community-dwelling adults participating in student-led health screenings in eastern Alabama. Between 2017 and 2019, students from health-related disciplines facilitated screenings at 23 community and independent living sites to conduct health assessments, including measuring blood pressure (BP), obtaining medical history, and evaluating current prescriptions. Statistical analyses, including chi-square tests, t-tests, and backward stepwise linear regression, were performed. The current sample includes data from 357 adults aged 60 to 99 years (mean age 74.6±8.7); who were 70.9% females, 60.8% identifying as Black/African American (BA), and 36.8% residing in rural areas. The majority of clients had a prior HTN diagnosis (71.1%) and/or currently measured HTN (78.7%). Forty-three percent of adults screened had measured, diagnosed, and pharmaceutically treated HTN, while 31% had measured but untreated HTN. Black clients had higher measured systolic and diastolic BP and were more likely to also have been diagnosed with and prescribed medication(s) for HTN ($p<.05$ for all). Linear regression indicated that higher systolic BP was predicted by living alone ($p=.003$), black race ($p=.004$), and previous HTN diagnosis ($p=.012$), while male gender ($p=.079$), and higher body mass index ($p=.053$) had marginal predictive value. These results suggest that while awareness and screening for HTN in this population are significant, management of the disease through ongoing screening and referrals is essential to reduce disparities.

Title: Evaluating gesture recognition in UAV-based human-robot interaction

Primary Author: Paxton Albright

Additional Authors: Chad Rose;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Gesture recognition is a computer vision technique that translates human movements into commands for human-robot interaction (HRI). Previous work has employed gesture recognition as an interface for various devices, such as video games, social robots, and unmanned aerial vehicles (UAVs). This research investigates the effectiveness of gesture recognition for HRI with autonomous UAVs, specifically examining how factors such as viewing distance and angle impact model performance. To explore these effects, a synthetic dataset was generated in the Unity Game Engine, featuring multiple subjects (ranging in height from a 5th percentile female to a 95th percentile male) performing two sets of five gestures. Gestures were observed at distances ranging from 10 to 50 feet and vertical angles from 0 to 90 degrees. The gestures were categorized into 2D and 3D sets, and machine learning models were trained separately on each dataset to evaluate whether 3D gestures enhance recognition performance without increasing computational costs. The findings of this research will inform future UAV gesture recognition studies by identifying the trade-offs between performance and computational constraints on UAV hardware.

Title: Grouping-Based Association Rule Mining to Predict Future Attributes in Database Queries

Primary Author: Peixiong He

Additional Authors: Libo Sun;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: In modern data management systems, SQL databases, as a mature and stable technology, have become the core for processing structured data. These databases ensure data integrity through strongly typed schema definitions and support complex transaction management and efficient query processing capabilities. In large SQL database environments, although numerous tables and fields of varying structures exist, a given query typically references only a small subset of them. This phenomenon characterizes the data as highly sparse, i.e., most table fields are unused in most queries. To cope with this data sparsity and complexity, this paper proposes a method for grouping different SQL statements. By combining these statements into sets and applying frequent pattern mining algorithms to identify repetitive patterns and associative relationships from huge data, we are able to optimize the query execution plan and adjust database indexes. This strategy provides more effective results than traditional frequent pattern mining methods in this scenario.

Title: Assessing postharvest texture variations in Rabbiteye and Southern Highbush Blueberries grown in Alabama

Primary Author: Peter Ephraim

Additional Authors: Michael Miller;Camila Rodrigues;Sushan Ru;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Blueberry (Vaccinium spp.) firmness is key for shelf-life and consumer acceptance. Variations in firmness have been extensively studied on southern highbush (SHB; Vaccinium corymbosum L.), with little reported on rabbiteye (RE; Vaccinium virgatum) genotypes. The research objective was to evaluate weight loss, firmness, and berry diameter on 14 RE and 3 SHB genotypes through 42 days of storage at 4 °C and 85% relative humidity. Measurements were taken on days 0, 14, 28, and 42 in storage. Firmness and fruit size were measured using a texture analyzer, and weight loss was recorded using a digital scale. Significant changes in measured attributes occurred, varying by cultivar. On day 42, RE genotypes of 'T-3081', 'Vernon', and 'T-3075' exhibited the lowest weight loss at 7.2%, 7.8%, and 7.9%, respectively. Conversely, 'MS1228R' (18.3%), 'MS1110R' (13.6%), and 'Titan' (13.2%) (RE genotypes) and 'Newhanover' (14.9%) (SHB genotypes) had the highest weight loss. On day 0, 'Titan' (RE) had the highest firmness (287 g.mm-1), while 'MS1110R' (RE) had the lowest (152 g.mm-1). On day 42, RE genotypes of 'Titan', 'Vernon', 'T-3075', and SHB 'Legacy' maintained high firmness (>200 gmm-1), while 'Alapaha' (RE), 'NewHanover'(SHB), and 'MS1110R' (RE) were lowest (<150 gmm-1). RE genotypes 'Titan', 'T-3081', and 'T-3075' had the largest diameter (24.9, 24.1, and 26.1 mm, respectively) at harvest, and retained fruit diameter through storage (23.7, 23.4, and 26.1 mm, respectively). Hierarchical Cluster Analysis (HCA) categorized cultivars into enhanced ('Titan', 'T-3075'), moderate ('Legacy', 'Overtime', and 'T-3081'), and suppressed firmness ('Alapaha', 'Krewer', 'Brightwell', and 'MS1110R'). HCA was crucial in selecting 7 RE and 3 SHB for future cell wall and texture analysis. This study provided valuable data for breeders to select RE cultivars with high firmness and increased shelf-life.

Title: Across this new divide: a comparison of electroolfactogram activity in the nasal septum of rats and cats

Primary Author: Pia Laporte

Additional Authors: Oleg Pustovyy;Ludmila Globa;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: It is well documented that the Olfactory Epithelium (OE) is home to the Olfactory Sensory Neurons (OSN) that are responsible for capturing odorant molecules for sensory processing, and in rats (Rattus norvegicus), a clear-demarcating line can be seen where the expression of the Immunohistochemical marker Olfactory Marker Protein (OMP) and Electroolfactogram (EOG) responses stop at the junction between the OE and Respiratory Epithelium (RE). In cats (Felis catus), the answer is not so clear, as no prior studies have evaluated the presence of OSN in the RE and the cat is generally less-thoroughly characterized than the rat. OMP, which is expressed by mature OSNs after synapse with the Olfactory Bulb, appears to be expressed diffusely and in patches of cell bodies in the RE of cats as well as throughout the OE. To investigate this further, we collected the nasal septum and associated epithelium of cats and rats for EOGs. While electrical responses to odorant stimuli were observed in the OE of both groups, isolated responses were additionally observed in the RE in cats but absent in rats as is consistent with the literature. There may be a multi-focal transition zone in the RE of cats where odorant collection is taking place outside of the OE, allowing for a greater relative surface area of OSN cilia exposure to odorant molecules within the nasal cavity.

Title: Molecular mechanisms of microbial adaptation to metals in soil ecosystems

Primary Author: Pierce Meinert

Additional Authors: Liam Brown;Isaiah Fowler;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Understanding how microbes respond to changes in metal availability in soil environments is vital for both environmental health and agricultural productivity. Metals, whether essential micronutrients like zinc and copper or toxic heavy metals like lead and mercury, significantly influence microbial community dynamics and functions. Microbial responses to metal availability affect processes such as nutrient cycling, organic matter decomposition, and soil fertility. Additionally, microbes can mediate the detoxification and immobilization of heavy metals, thereby mitigating soil and water contamination. By unraveling the mechanisms of microbial adaptation to varying metal concentrations, we can develop sustainable practices for managing soil health. We sampled soil treated with standard fertilization, and standard fertilization with micronutrients to compare bacteria that have adapted to environmental conditions with excess metallic micronutrients. We isolated and genotyped more than 100 soil isolates from these soil samples. We then characterized cellular response to excess metals in the laboratory. We found that most soil bacteria were sensitive to excess levels of ZnCl2 and MnCl2 but certain microorganisms were more tolerant to toxic metals. Finally, we investigated the mechanism of reduced cell growth by profiling ribosome adundance and activity in cells grown in excess metals. We found that excess metals lead to a specific reduction in actively translating ribosomes in organisms that were sensitive to metal treatment. Together, these results elucidate mechanisms that govern adaptation of soil bacteria to varying levels of metals in the environment.

Title: A Novel Magnesium Thiosulfate-modified Biochar for Enhanced Nutrient Use Efficiency in Agriculture

Primary Author: Pradip Adhikari

Additional Authors: Hossein Jahromi;Nitesh Kasera;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The extensive use of chemical fertilizers and animal manure has led to soil health and environmental problems such as lower nitrogen use efficiency, eutrophication, and nitrous oxide (N2O) emissions. Biochar, a pyrolysis product of organic waste matter, can be a promising and climate-friendly material for addressing these environmental issues, but its efficacy may vary according to modification techniques. Magnesium-modified biochar using MgCl2 salt is considered good sorption towards ammonium and phosphate in aqueous solution because of its improved physicochemical and surface properties; however, the optimum magnesium doping to maximize the nutrient adsorption capacity is still unclear. Moreover, the chlorine content in the biochar can further stress soil towards chlorine toxicity. Therefore, this study aimed to modify pine biochar using alternative magnesium sources and understand the mechanism for nutrient adsorption. Biochar was modified with magnesium thiosulfate (1-10 percent doping) to produce Mg-doped biochar using pre- and post-modification techniques. Pre-modified 6-MgBC and post-modified 10-MgBC had better nutrient adsorption performance. Both the biochar samples showed higher adsorption capacities for NH4+-N and PO43- and were best fitted by the Langmuir isotherm model, indicating the monolayer adsorption process. The maximum adsorption capacities for NH4+-N and PO43- by pre-modified 6-MgBC were 106.58 and 154.27 mg/g, respectively, and for post-modified 10-MgBC were 142.09 and 165.09 mg/g, respectively. Our results demonstrated that magnesium thiosulfate could be effectively used to modify pine biochar as an alternative magnesium source for adsorbing NH4+-N and PO43-.

Title: Harnessing salt-tolerant PGPR for effective management of Meloidogyne Incognita in cotton

Primary Author: Prativa Chhetri

Additional Authors: Kathy Lawrence;Bisho Lawaju;Gayatri Bhandari;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The Southern root-knot nematode (Meloidogyne incognita, sRKN) poses a significant threat to cotton production, necessitating sustainable management strategies such as using salt-tolerant plant growth-promoting rhizobacteria (ST-PGPR). This study evaluates the potential of ST-PGPR strains to enhance plant health and suppress sRKN through nitrogen fixation, siderophore production, and direct nematicidal activity. Nitrogenase activity was assessed using nitrogen-free JNFb media with bromothymol blue as a pH indicator, where a color shift from yellow to blue (alkaline) and pellicle formation indicated nitrogen fixation. By Day 3 of inoculation, Curtobacterium oceanosedimentum (ST-42), Bacillus velezensis (ST-68), Pseudomonas neuropathica (ST-177), and Pseudomonas koreensis (ST-217) exhibited strong nitrogenase activity, with 38.04% of strains demonstrating high activity overall. Given that nitrogen fixation enhances plant vigor, siderophore production was subsequently examined to assess iron acquisition, a crucial factor in microbial competitiveness and plant growth promotion. Using Chrome Azurol S (CAS) agar, Pseudomonas glycinae/kribbensis (ST-170/211), Pseudomonas anguilliseptica (ST-161), and Luteibacter yeojuensis (ST-7) formed distinct orange/yellow halos, with P. glycinae/kribbensis (ST-170) exhibiting the strongest siderophore production (1.42 cm halo). As both nitrogen fixation and iron chelation contribute to rhizosphere competency and potential antagonism against pathogens, the ability of ST-PGPR strains to suppress sRKN was tested through an in vitro J2 mortality assay. A total of 159 strains were screened by incubating sRKN second-stage juveniles (J2) with bacterial suspensions (1×10^7 CFU/ml) for 48 hours, using 10 ppm fluopyram as a positive control and deionized water as an untreated control. Several strains exhibited significant nematicidal effects, with Psychrobacter nivimaris (ST-97) (96.89%), Isoptericola halotolerans (ST-105) (96.60%), Bacillus vietnamensis (ST-167) (94.89%), and Bacillus safensis (ST-172) (94.32%) inducing the highest J2 mortality, followed by Priestia aryabhattai (ST-128) (91.01%). These findings suggest that ST-PGPR strains promote plant growth through nitrogen fixation and siderophore production and provide biocontrol potential against sRKN, supporting their use as multifunctional bioinoculants for sustainable cotton production. Future studies will focus on molecular characterization of nitrogenase and siderophore production, along with greenhouse, micro-plot, and field trials to validate nematode suppression and yield improvement.

Title: Alcohol-carboxylate co-transport to crosslinked PEGDA based ion exchange membranes with phenyl-containing blocking groups of different chain lengths

Primary Author: Pravin Parasakthi Aravindhan

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Fuel cell devices such as photoelectrochemical CO2 reduction cell (PEC-CRC) convert CO2 into various chemicals such as alcohol (methanol) and carboxylate ions (formate and acetate). These devices require ion exchange membranes that prevent crossover (transport) of chemical species with sufficient ionic conductivity. Additionally, the transport of a particular chemical is affected due to the presence of other products. Therefore, understanding the effect of membrane structure towards chemical (solute) transport is essential. Previously, our group observed increased acetate transport when it is in co-transport with fast diffusing methanol to poly(ethylene glycol) diacrylate (PEGDA) based crosslinked membranes. The addition of uncharged monoacrylate poly(ethylene glycol) phenyl ether acrylate (PEGPEA) monomer decreased acetate transport. Furthermore, the inclusion of charged monoacrylate 3-sulfopropyl methacrylate potassium salt (SPMAK) enhanced ionic conductivity with an undesirable increase in acetate and methanol transport. At certain compositions of SPMAK and PEGPEA, acetate transport is suppressed in co-transport with methanol, which is desirable to PEC-CRC. The two main factors that affect the solute transport in these crosslinked membranes are membrane water uptake and fixed charge concentration, and it is pertinent to isolate and investigate their individual impact on solute transport. Therefore, tunable crosslinked membranes with varying SPMAK content and three different uncharged monomers of increasing chain length, namely phenyl acrylate (PA), ethylene glycol phenyl ether acrylate (EGPEA) and PEGPEA are utilized. Membranes with constant water uptake, varying charge concentration, and varying water uptake, constant charge concentration were prepared as a result. In the future, membrane transport experiments will be carried out to better understand the underlying transport-physiochemical property relationships.

Title: Genomic exploration of indigenous populations: A systemic review unveiling insights, challenges, and ethical considerations (Encore)

Primary Author: Preston Cook

Additional Authors: Courtney Alexander;Maddie Northington;Rishi Nadar;Austin Moore;Abbie Holmes;Timothy Moore;Muralikrishnan Dhanasekaran;Mary Ellen Sinnott;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Pharmacogenomics (PGx) studies how genetic makeup influences drug responses, enabling personalized medicine to enhance efficacy and reduce side effects. While PGx has advanced globally, Indigenous populations remain underserved. This review explores PGx's history, advancements, and challenges, with a focus on the Maldives, Southeast Asian Pharmacogenomics Research Network (SEAPharm), and barriers to implementation in developing countries and Islamic cultures. A comprehensive literature review was conducted utilizing the following search terms: "Maldives," "pharmacogenomics," "Indigenous populations," "Southeast Asian pharmacogenomics research network," "ethics," and "challenges." PGx testing identifies genetic variations that impact drug metabolism, improving treatment outcomes. However, its global application remains limited, especially in developing countries. Research in the Maldives, such as studies on Chikungunya and beta-thalassemia, showcases PGx's potential. SEAPharm's research highlights genetic diversity affecting drug responses. Challenges include limited facilities, logistical issues, and cultural barriers, especially in Islamic nations. Effective PGx integration requires collaboration and culturally sensitive approaches. PGx can revolutionize healthcare by tailoring treatments based on genetic profiles, improving efficacy and minimizing side effects. Despite challenges, PGx's integration into healthcare systems, like in the Maldives, promises improved outcomes and advances in personalized medicine.

Title: Molecular Tug-of-War: How S. aureus Adhesins Resist Host Defenses Under Force

Primary Author: Priscila da Silva Figueiredo Celestino Gomes

Additional Authors: Rafael Bernardi;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Staphylococcus aureus use an arsenal of virulence factors to target and adhere to their host. Adhesins play a critical role in anchoring bacteria using an ultrastable mechanoactive bond, reinforced by mechanical stress. Through bioinformatics, AI-based protein structure prediction and steered molecular dynamics (SMD) simulations, we have investigated several adhesins such as SdrD and SdrE. Our results have shown that these proteins can sense forces and become activated to resist high shear hydrodynamic force loads found during host infection, with rupture forces over 2nN, which is equivalent of breaking covalent bonds. Results were validated using atomic force microscopy (AFM) based single cell and single molecule force spectroscopy experiments. We observed that SdrD's interaction to human skin receptor desmoglein-1 is highly regulated by calcium ions while SdrE interaction to human complement factor H seems to be increasing resilience over time. In particular, SdrE adhesins from recent methicillin resistant S. aureus strains (MRSA) are more resilient to shear forces than older S. aureus strains that have not been exposed to methicillin or are sensitive to methicillin (MSSA). Our study illustrates the crucial importance of protein mechanobiology in governing pathogenesis and our in-silico data can be exploited for the development of antiadhesion strategies as an innovative alternative to antibiotics.

Title: Unsupervised Clustering of Protein Language Model Embeddings for Homology Detection

Primary Author: Priscilla Udomprasert

Additional Authors: ;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Homology detection plays a crucial role in understanding protein evolution and functional annotation. Traditional sequence similarity-based approaches often struggle to detect remote homologs with low sequence identity, necessitating the use of structure-based or machine learning methods. Recent advancements in protein language models have provided new opportunities for improved homology detection by generating meaningful sequence representations. However, efficient clustering of these embeddings to extract homologous relationships remains a challenge. Our work employs a protein language model to generate embeddings that capture evolutionary and functional signals from protein sequences. Using an unsupervised clustering approach, we systematically optimize the grouping of protein sequences based on these embeddings. The impact of different clustering parameters, including the number of clusters and dimensionality reduction techniques, is evaluated to enhance homology detection. Comparative analyses with existing methods assess the accuracy and scalability of this approach. Our approach effectively identifies homologous relationships by leveraging protein sequence embeddings and unsupervised clustering. It demonstrates strong performance in grouping related proteins while maintaining scalability for large datasets. The method shows promise in reconstructing evolutionary relationships and functional similarities, offering a computationally efficient alternative to traditional sequence alignment techniques. These findings highlight the potential of embedding-based clustering for large-scale protein analysis and annotation.

Title: Optimizing Log Truck Transportation: Analyzing Route Safety & Transportation Efficiency Between Interstate and Traditional Routes

Primary Author: Puspa Raj Joshi

Additional Authors:

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Alabama is rich in forest resources, and the majority of the timber produced is supplied to primary forest-based industries spread across the state. Log trucking plays a critical role in sustaining this forest supply chain by transporting unprocessed timber from harvesting sites to mill locations. However, log truck transportation poses inherent risks and challenges. To deliver timber to mills, log trucks has to travel on state's extensive primary and secondary routes that often pass through busy urban areas creating a safety hazard for general public as well as log truck drivers often leading to fatalities. Frequent crossing of traffic intersections, acceleration and deceleration at stop signs, tight turns required by log trucks are the main causes of accidents. Further, accidents involving log trucks leads to costly lawsuits, driving up insurance premiums and threatening the profitability of the industry. Unlike primary and secondary routes, interstate highway offers significant advantage for log truck travel. However, log truck frequently avoid travelling loaded in interstate highways. A key factor limiting the use of interstate highways for log truck transportation is their weight restrictions, which prevents log trucks from carrying state-legal load (Gross Vehicle Weight = 88,000 lbs). An industry that is already struggling with rising cost of insurance premium and fuel prices, travelling with less loaded on interstate highway make it challenging for them to maintain daily operational cost. But interstate highways offer distinct advantages over conventional routes. Their higher design standards with fewer traffic intersections, stop signs and streamlined traffic flow would reduce the likelihood of accidents while stabilizing the insurance premiums. Thus, travelling with state legal load on interstate while travelling at faster speed would enable log trucks to deliver larger volumes of timber in less time, enhancing both safety and efficiency. Using Advance GIS network analysis and route optimization techniques, this study aims to evaluate the relative safety, economic benefits, and operational efficiency of using interstate highways compared to current routes for log truck transportation in Alabama. Findings from this study will have important implications for improving log truck transportation safety and efficiency in Alabama and beyond. Keywords: Efficiency, Interstate, Log truck transportation, Route analysis, Safety

Title: Screening plant growth promoting rhizobacteria in cotton for growth promotion and insecticidal activity

Primary Author: Rachel Livingston

Additional Authors: John Beckmann;Kathleen Martin;Vinita Gupta;Isabella Owens;Richard Murphy;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Cotton is a major global crop, contributing to many consumer goods. In the U.S., the value of cotton production reached $4.6 billion in 2023. Cotton is vulnerable to various insect pests that can damage crops and reduce yields, including the cotton aphid (Aphis gossypii) and the tarnished plant bug (Lygus lineolaris). Plant growth-promoting rhizobacteria (PGPRs) are bacteria associated with roots or that reside inside plants, which have properties that can enhance plant yield, both directly and indirectly. Recently, interest in PGPRs has surged, leading to investigations into their agricultural applications for growth promotion, nutrient management, and biological pesticides. This study aims to identify strains from the Auburn PGPR libraries that promote cotton growth and demonstrate insecticidal activity against A. gossypii or L. lineolaris. Over 500 PGPR strains were assessed for insecticidal activity against Drosophila melanogaster using a multi-tier bioassay pipeline. The strains identified with insecticidal properties were further tested against specific insect pests, revealing 13 strains with significant insecticidal activity against A. gossypii and another 13 strains against L. lineolaris. It is hypothesized that inoculating cotton with these effective strains will aid in managing insect pests and may also promote cotton growth. To test this hypothesis, the PGPR strains are currently being evaluated under greenhouse conditions for their toxicity to cotton, growth promotion capabilities, and insecticidal activities resulting from plant feeding. Various application strategies are being developed and assessed for both growth enhancement and biopesticide use in managing A. gossypii and L. lineolaris in cotton. Preliminary data on cotton shows three strains having insecticidal activity or reducing reproduction in aphids. The goal of this study is to identify one or a combination of PGPRs that enhance cotton growth and are effective for managing insect pests.

Title: The association with financial literacy and the investment of cryptocurrency

Primary Author: Rachel Rodriguez

Additional Authors: Di Qing;

Department/Program: Finance

College: Harbert College of Business

Abstract: Financial literacy plays a crucial role in individuals' ability to navigate complex investment decisions, including the recent and rapidly evolving cryptocurrency market. As digital assets continue to gain more and more attention, a comprehensive understanding of cryptocurrency investments is becoming increasingly essential. This study utilised the Survey of Household Economics and Decision-making datasets to examine the association between financial literacy and investment in cryptos. This study aims to analyze the determination and motivation to invest in cryptos. Firstly, this study focuses on demographic information in relation to the analyzed data. Secondly, this research investigates if there is a significant difference in holding cryptos based on the financial literacy level using chi-square estimation. In addition, we demonstrate the holding behavior among different groups. The findings from this study uncover whether individuals with higher financial literacy are more strategic investors, while those with lower financial literacy may be more tempted to make uninformed or risky decisions. This study will conclude the first examination and determine whether increased financial education should be pushed to create responsible investment decisions in the cryptocurrency market. The findings have implications for future financial education programs and individuals looking to make informed investment choices in the rapidly evolving digital economy. Particularly for Auburn students, this study can enhance their knowledge of the financial sector and lead to more rational decisions when making investments rather than following popular trends. The results from this study can ensure that Auburn students are better prepared for the evolving digital economy. Furthermore, the implications of this study potentially influence financial planning for students and foster long-term financial stability and well-being among the community as a whole.

Title: Atom-by-Atom Investigation of Host-Pathogen Interactions: A Million-Atom Exploration of Trypanosoma cruzi Infection

Primary Author: Raissa Santos de Lima Rosa

Additional Authors: Manuela Leal Da Silva;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Chagas disease, caused by the protozoan Trypanosoma cruzi, affects millions of people, leading to severe cardiac and gastrointestinal complications in its chronic phase. One of the invasion mechanism of host cells by T. cruzi is mediated by the interaction between the parasite's glycoprotein gp82 and the human receptor lysosome-associated membrane protein 2 (LAMP2). While experimental studies have identified a few residues involved in this interaction, a comprehensive molecular-level understanding has been lacking. In this study, we present a 1.44-million-atom computational model of the gp82:LAMP2 complex, including over 3,300 lipids, glycosylation sites, and biologically relevant membrane compositions, making it the most complete model of this interaction to date. Using microsecond-long molecular dynamics simulations and dynamic network analysis, we identified critical residue interactions, including novel regions of contact that were previously uncharacterized. Specifically, we uncovered interactions such as gp82R215:LAMP2331-339 and gp82K244:LAMP2V154,156-157, which had not been previously described. Furthermore, our analysis highlights the significant role of the transmembrane (TM) domain of LAMP2 in stabilizing the complex. Initially forming distinct communities, the TM region became more integrated with the rest of LAMP2 as the simulation progressed, indicating increased connectivity within the complex. We also examined the role of glycans and membrane lipids, finding that gp82 O-glycans—particularly O-gly-S3 and O-gly-T17—exhibited strong interactions with the host membrane, while LAMP2 showed fewer interactions with the T. cruzi membrane. However, these biomolecules appeared to have a limited impact on gp82:LAMP2 binding after complex formation. Our study not only confirms key experimental observations but also reveals novel molecular interactions crucial for T. cruzi invasion. By identifying new binding regions and molecular targets, our findings provide a foundation for the development of therapeutic strategies to combat Chagas disease.

Title: First Report on the Bioherbicidal Potential of Dogfennel (Eupatorium capillifolium): Uncovering the Hidden Side of a Native North American Weed

Primary Author: Rakesh Ghosh

Additional Authors: Aniruddha Maity;Melissa Boersma;Andrew Price;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The over-reliance on herbicides has led to the development of herbicide-resistant weeds, with 534 cases identified globally by January 2025, highlighting the urgent need for ecologically based weed management strategies. Eupatorium capillifolium (Lam.) Small (dogfennel, DF), a perennial invasive weed native to North America, is widely distributed in Southeastern United States pastures and rangelands. However, its potential as a bioherbicide remains unexplored. The present study investigates the effect of DF aqueous extract on seed germination of thirteen weeds (nine broadleaf and four grass) and four corps (peanut, corn, soybean, and cotton). A 10% aqueous DF extract inhibited seed germination by 92.62-100% in four weeds from the Amaranthus genus: Palmer amaranth (PA), waterhemp (WH), redroot pigweed (RR), and smooth pigweed (SPW), and had minimal inhibition (6.12-6.25%) in corn and peanut. The extract exhibited low or no effect on seed germination of other broadleaf weeds (prickly sida, curlydock, morning glory, etc.) and grass weeds (Italian ryegrass, large crabgrass, and barnyard grass). Furthermore, DF extract reduced the shoot and root lengths of weed seedlings, indicating its allelopathic potential. The principal component analysis identified the inhibition of seed germination as the primary effect of DF extract on weed species. Dose-response assays exhibited different germination inhibition levels (GI50) among Amaranthus species, with SPW (0.2687%), RR (0.5572%), PA (1.048%), and WH (1.811%). Phytochemical analysis identified compounds like gallic acid, hydroxy-1,4-benzoquinone, (-)-alpha-Cedrene, acetophenone, gentisic acid, and caryophyllene oxide, likely contributing to the bioherbicidal effects. This is the first report on DF's bioherbicidal potential against Amaranthus species, highlighting its potential for integrated weed management and offering a sustainable alternative to chemical herbicides, particularly considering herbicide resistance.

Title: Effect of genetic strain and diet on the severity of Wooden Breast myopathy and PECTORALIS MAJOR muscle compression properties in broilers

Primary Author: Randy Nickli Domer

Additional Authors: Jessica Starkey;John Wesly;Jorge Luis Sandoval Escobar;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The etiology of Wooden Breast (WB) myopathy in broilers remains poorly understood. Elucidating the underlying mechanisms of this disorder is essential for developing strategies to mitigate its economic impact on the broiler industry. Previous research demonstrated that reduction in ME, dLys, and dMet in the diet (R) delayed but did not prevent WB onset in fast-growing (FG) broilers compared with those fed a control commercial diet (C). Therefore, the inclusion of a "heritage-type," slow-growing broiler strain (SG) as an unaffected control was investigated for feasibility. While manual palpation using a 4-point scoring system is the current standard for WB diagnosis in live birds, its subjective nature necessitates validation through objective measures such as mechanical compression analysis. WB severity and pectoralis major muscle compression (PMC) properties were evaluated in female FG broilers fed either the C (FGC) or R (FGR) diet and SG broilers fed the C diet (SGC). Birds were reared in floor pens (n = 20 per pen; 15 pens per treatment) and BW, FI, and WB severity were determined on days 0, 7, 14, 21, 28, 35, and 46 post-hatch. On day 47, birds were processed and the 3 closest to the pen median were selected for PMC analysis. Data were analyzed as a 1-way ANOVA using SAS (v9.4) PROC GLIMMIX and PDIFF for mean separation at $P \leq 0.05$ and Spearman correlation analysis to determine the association among WB score and PMC. S strain had higher initial BW than FG ($P < 0.0001$); FGC were heaviest and SGC were lightest on d 46 ($P < 0.0001$). FGC yielded the heaviest carcasses and SGC yielded the lightest ($P < 0.0001$). Importantly, SGC maintained 100% normal fillets from day 0 to 46, while FGC were 100% WB-affected by day 28. Live WB scores correlated positively with PMC values (r2 = 0.49; $P < 0.0001$), validating our live manual palpation method. The inclusion of SGC broilers is warranted in WB research, and the 4-point palpation system is a credible method to assess WB severity.

Title: Elucidating Impact of Biochar Amendment and Cropping Systems on Soil Water Movement and Retention Characteristics

Primary Author: Ranveer Singh

Additional Authors:

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract:

Title: Life Cycle Assessment of PP, PLA, and PLA+Biochar Plant Container Production and End-of-Life

Primary Author: Raziyeh Jokar

Additional Authors: Sushil Adhikari;Hossein Jahromi;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: One major use of plastics is in the horticulture industry, where more than 4 billion plastic plant containers are used each year in the United States. Unfortunately, 98% of these containers end up in landfills. To address this problem, biodegradable options have been developed, including plant containers made from polylactic acid (PLA). This study examines a sustainable solution by adding biochar to PLA-based containers to reduce their environmental impact, especially at the end-of-life stage. A life cycle assessment (LCA) was carried out to compare plant containers made from polypropylene (PP), PLA, and PLA+Biochar (10 wt.%), looking at their effects from production to disposal. The system boundary is set from cradle to grave, including production, distribution, collection, and end-of-life scenarios based on U.S. waste management data. The functional unit is 1,000 containers, each with a capacity of 3 liters. The life cycle inventory was developed using literature sources and the ecoinvent database, with additional inputs from the USLCI-NREL database. The environmental impacts were evaluated using the IMPACT 2002+ method, which covers important categories like land occupation during the end-of-life phase. Results show that during production, PP containers have the lowest global warming potential (GWP) at 73.89 kg CO_2-eq per functional unit, while PLA and PLA+Biochar (10 wt.%) containers have higher impacts at 146.98 and 125.29 kg CO_2-eq, respectively. However, adding biochar to PLA helps lower the overall environmental impact. The end-of-life analysis also shows benefits when composting PLA+Biochar containers, as biochar helps store carbon in the soil. The GWP for containers made of PP, PLA, and PLA+Biochar is 23.16, 26.84, and -0.46 kg CO_2 per kg functional unit, respectively. These findings highlight the promise of biochar-enhanced bioplastics as a more sustainable option for horticultural use.

Title: The effectiveness of micro-breaks in on-duty patrol officers

Primary Author: Reagan Boledovic

Additional Authors: Joellen Sefton;Russell Lowell;Daniel Lawson;Katherine Frick;

Department/Program: School of Kinesiology

College: College of Education

Abstract: This study evaluated the effectiveness of micro-breaks in reducing musculoskeletal pain and stress levels among police department employees, a population often exposed to prolonged sedentary periods while on duty. Micro-breaks, defined as short, scheduled stretching sessions with mindful breathing, were implemented once an hour during shifts over a 16-week period. Week 1 stress levels positively correlated with upper back pain ($r = 0.73$, $p = 0.003$), neck pain ($r = 0.52$, $p = 0.055$), and lower back pain ($r = 0.61$, $p = 0.111$). Strong negative correlations were observed between stress levels and both partial ($r = -0.70$, $p = 0.016$) and full ($r = -0.64$, 0.035) completions of the micro-breaks protocol. Mixed-effects models revealed no statistically significant effect of time on stress levels ($\beta1 = -0.037$, $p = 0.373$) or lower back pain ($\beta1 = -0.066$, $p = 0.260$). Individual analysis revealed a moderate negative correlation in neck ($r = -0.55$, $p = 0.125$) and a near perfect negative correlation with upper back pain ($r = -0.93$, $p < 0.001$) over time for Subject 1. Very strong negative correlations for stress ($r = -0.72$, $p = 0.043$) and low back pain ($r = -081$, $p = 0.017$) over time were observed for Subject 2. These findings suggest that while group-level effects were not significant overtime, individual-level improvements in pain and stress indicate the potential for individualized micro-break strategies to mitigate occupational health risks among police officers.

Title: Investigation of gender performativity and identity development for engineers.

Primary Author: Rebecca Strain

Additional Authors: Eric Burkholder;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Prior identified discrepancies between the self-identified and reflected appraisals of masculinity for those assigned female at birth (AFAB) in physics classes. This was correlated with a lower sense of belonging, which is a key part of developing engineering identity and completing an engineering degree. The objective of the research was to investigate these relationships using data collected in engineering physics I & II classes. Students were asked to rate their self-identified and reflected appraisals (i.e., how they think others view them) of gender on a gradational scale for both masculine and feminine qualities. They were also asked a series of questions about their physics and engineering identity (i.e. how well the student believes they belong in their respective major and/or physics class). Using regression analysis, it was observed that AFAB students felt more seen as an engineer if they felt others didn't perceive them as highly feminine. Curiously, those assigned male at birth (AMAB) reported that feeling more masculine internally than they felt they were perceived made them feel more like an engineer, but the effect was much smaller than for those AFAB. These data support the fact that AFAB students seem to not only be more attuned to how they perform their gender in engineering, but also that it has a larger impact on their identity as engineers.

Title: Exploring sand excavation potential in dark southern drywood termite Kalotermes approximatus

Primary Author: Rebecca Valentine

Additional Authors:

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Termites exhibit diverse nesting behaviors, with a major transition between one-piece nesters, whose entire colony life is completed within a single piece of wood, and foragers, who use physically separated food sources often by connecting them with underground tunnels. Among termite diversity, Kalotermitidae is a lineage of primarily one-piece nesters, and many species are adapted to using a limited amount of wood resources. However, it remains questioned if such strict one-piece nesting is the ancestral state of the Kalotermitidae evolution. In this study, we investigate the potential to excavate tunnels in sand in Kalotermes approximatus. This species is a typical one-piece nester in the southeastern United States and is an early diverged (basal) species of Kalotermitidae diversity. We found that K. approximatus engaged in tunneling behavior to find other food sources. In a planar arena filled with sand, termites constructed complete tunnels between food sources (separated 7 cm) within 48 hours, with larger groups constructing tunnels more quickly. Their behavioral repertoire of tunneling is similar to that of Paraneotermes simplicicornis, a unique kalotermitidae species classified as a forager, where termites kick substrates back to the next termite in line rather than grabbing substrate with their mandibles and carrying it out of the tunnel. These observations imply that the common ancestor of Kalotermitidae had the potential to build tunnels.

Title: Fiestaware: The Development of a Cultural Icon

Primary Author: Rebekah Tillery

Additional Authors:

Department/Program: School of Industrial and Graphic Design

College: College of Architecture, Design and Construction

Abstract: Fiestaware, a prolific line of colorful dinnerware, has long been a cultural phenomenon. Produced in Newell, West Virginia, it enjoyed nearly instant success upon its debut in 1936, likely due to the fact that it was widely available, cheap and featured bright colors and a clean design that appealed to a post-Depression rising middle class. However, changing consumer tastes and an economic depression in the 1970s proved detrimental, and the line was discontinued in 1973. However, a secondhand market for Fiestaware sprung up almost immediately, and surprising customer demand triggered a return of the line in 1986. Today, Fiestaware continues to flourish thanks to creative marketing, a commitment to craft, and the devotion of its collectors. Why Fiestaware has succeeded where other American-made dinnerware lines have failed is a matter of debate. However, this question can largely be answered by considering that Fiestaware's widespread availability, innovative marketing, and timeless design established the line as a fixture of American culture. By examining historical sources and extensive scholarship, this project will assess Fiestaware's popularity through the years, with a particular emphasis on the cultural perception of the line during its initial launch in 1936 and its reemergence in 1986, in order to illuminate how a mass-produced item like Fiestaware can take on deeper aesthetic significance and become a cultural icon reflective of American values.

Title: ERBB4 Heterodimers Appear to Drive BRAF WT Melanoma Cell Lines

Primary Author: Rees Cooke

Additional Authors: David Riese;Maddy Ingrao;Ella Wilson;Joelle Woggerman;Kaitlyn O'Daniel;Jennifer Davis;Lauren Lucas;Vipasha Dwivedi;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Metastatic melanomas with wild-type (WT) BRAF alleles are equally aggressive as those melanomas with gain-of-function BRAF mutations (e.g., V600E). The purpose of this experiment is to assess whether the heterodimerization of ERBB4 with EGFR or ERBB2 promotes the proliferation of BRAF WT melanoma cell lines. We are investigating whether WT EGFR or ERBB2 alleles promote the proliferation of four distinct human BRAF WT melanoma cell lines. Additionally, we are assessing whether the dominant-negative EGFR (K721A) or ERBB2 (K753A) mutant alleles suppress proliferation in these cell lines while also evaluating the effect of EGFR or ERBB2 shRNAs on inhibiting their proliferation. Lastly, we are examining whether EGFR or ERBB2 enables ERBB4 mutant alleles, identified in BRAF WT melanoma samples, to drive higher levels of proliferation in 32D cells compared to WT ERBB4. WT ERBB2 significantly enhances the proliferation of the MEL-JUSO and IPC-298 BRAF WT female melanoma cell lines. The ERBB2 dominant-negative allele notably reduces their proliferation. Preliminary data indicate that the dominant-negative alleles of EGFR and ERBB2 suppress the proliferation of the MeWo BRAF WT male melanoma cell line. Our data suggests that ERBB2-ERBB4 heterodimers drive proliferation in two female BRAF WT melanoma cell lines, whereas ERBB2-ERBB4 and EGFR-ERBB4 heterodimers contribute to proliferation in male BRAF WT melanoma cell lines. Therefore, we propose that FDA-approved ERBB2 inhibitors-and in some cases, EGFR inhibitors could be effective in ERBB4-dependent BRAF WT melanomas. Furthermore, ERBB4 heterodimerization with ERBB2 or EGFR may explain the gender disparities observed in BRAF WT melanomas.

Title: Impact of visible implant fluorescent elastomer (VIE) tagging on growth and survival of Procambarus clarkii juveniles

Primary Author: Renee Hintz

Additional Authors: Jim Stoeckel;Tatum Osmon;Golara Kor;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Procambarus clarkii, commonly known as the Red Swamp Crayfish, is a species of crayfish native to parts of the Southeastern US and Northern Mexico. It is now one of the most invasive species worldwide due to its popularity as a food item, research organism, and aquarium pet. Development and evaluation of control techniques for invasive populations often require tagging of crayfish so that individuals can be tracked through time and development stages. However, this is complicated by the fact that crayfish periodically molt. Internal VIE tags that are injected into crayfish muscle tissue may be a good alternative to external tags if they remain intact and visible through multiple molt cycles and have negligible impacts on survivorship and growth. Laboratory studies were conducted to test the feasibility of VIE tags on two size classes of crayfish (7±1mm carapace length and 17±1mm carapace length). Within each size class, 10 crayfish were tagged, while the same number were untagged and served as controls. Tag retention and visibility, crayfish survival, and growth were monitored weekly for 8 weeks. Results thus far show no significant effect of tagging on the growth and survivorship of either size class, though tag visibility (evaluated both with and without UV light to fluoresce tags) has started to decline. VIE tags appear to be an effective tool for tagging and tracking individual crayfish from a small size (7±1mm carapace length) through multiple molt cycles for at least 8 weeks. Future research should examine tag visibility over a longer term (>8 weeks) to determine whether periodic re-tagging is required to renew tag visibility.

Title: Examining Postural Responses to Perturbations in 3D: A Pilot Study

Primary Author: Rhet Hailey

Additional Authors: Chad Rose;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Affecting muscle spasticity, strength, and coordination, stroke results in alterations to muscle control and ability to compensate from unexpected perturbations. Post-stroke, upper extremity movements are heavily modified from perturbations, which increase the difficulty of activities of daily living (ADLs). Postural responses from upper extremity perturbations in healthy and stroke populations have been examined in movements constrained to 2D planar motion, and may provide insight as an assessment tool to help inform therapists to better structure rehabilitation training regimens towards individualized health care for improved long-term outcomes. However, implications on constraining motion in the horizontal plane are not clear, and may reduce the generalizability of the findings to the movement through unconstrained 3D space necessary for ADLs. In this paper, we explore the effects of joint perturbations on the elbow and shoulder in unconstrained, gravity-compensated position holding tasks. We present a metric-diverse, dynamic task framework building upon previous 2D experiments designed to better assess rehabilitative efforts in movement trajectories with applied gravity compensation in three dimensional space aimed towards the generalizability of 3D motion. Results suggest that motion of multi-DoF joints display varied movement qualities in 3D space with robotic gravity compensation when compared to constrained planar movements.

Title: Development of a core flooding experiment for deeper understanding of changes in porosity and permeability of carbonate core samples subject to carbon dioxide sequestration

Primary Author: Riana Rivera

Additional Authors: Otis Williams;Lauren Beckingham;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Understanding carbonate rich minerals and their structures is crucial for predicting the impacts of dissolution and precipitation reactions when carbon dioxide is sequestered underground during carbon capture and storage. 3D X-Ray Computed Tomography (XCT) is a non-destructive imaging technique that is used to view pore structures within carbonate core samples, however XCT provides limited visibility and characterization of the reactive surface areas within these pores. To better understand the complex pore structures within carbonate core samples a U-net deep learning algorithm was utilized to calculate multi-scale porosity, pore connectivity, pore-size distribution, and accessible surface area. In this work, a core-flooding reactivity experiment was developed to better model and predict the changes in a carbonate cores porosity and permeability following the reactions between carbonate minerals, carbon dioxide, and brine. Post experiment analysis will include comparison of pre and post reaction XCT images.

Title: Tangled up In blue: Identifying the source and role of pigmentation in Cassiopea

Primary Author: Riley Kishbaugh

Additional Authors: Katherine Buckley;Megan Maloney;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Marine invertebrates exhibit a remarkable array of variation in color patterns that often contribute to organismal physiology. The upside-down jellyfish (Cassiopea spp.) exhibit extraordinary variation in their oral appendages (laplets), most strikingly, a brilliant blue color. Recent evidence suggests that, during an acute heat stress, individuals with blue laplets survive higher temperatures than those without. While the blue pigment in Cassiopea has been speculated to be produced by the 'Cassio blue' protein, the mechanisms underlying the population-level variations in color morphology remain poorly understood. Using the Cassiopea xamachana genome, we identified several genes closely related to other known blue proteins (rpulFKz1). We therefore seek to investigate which of these genes is responsible for pigment production and where they are expressed. RNA was extracted from a polyp, ephyra, adult blue laplet and adult brown appendage for reverse transcription to analyze mRNA gene expression. Genes that were expressed in blue tissue, but not other tissues were heterologously expressed in E. coli using an arabinose-inducible expression system. If the gene is responsible for pigment production, induced bacteria should produce a blue color. Results from these experiments and RNAseq suggest that blue pigment could be the result of several genes. Understanding mechanisms that allow species to survive stress has become increasingly important as climate change continues to threaten marine taxa; identifying the source of Cassiopea pigment may allow us to better understand their ecology and perseverance under stressful circumstances.

Title: Establishing an infection model for <<Patiria miniata>> larval immune response

Primary Author: Riley Sciambra

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Echinoderms present a distinct model for investigating the evolutionary pathways that led to the emergence of vertebrate adaptive immunity. As invertebrate deuterostomes, echinoderms occupy a phylogenetic niche for examining the shift from innate to adaptive immune systems. The bat star <<(Patiria miniata)>> offers both the benefits of this phylogenetic position and a novel model for comparative studies with the better characterized purple sea urchin <<(Strongylocentrotus purpuratus)>>. Given that <<S. purpuratus>> larvae respond to bacterial challenge by <<Vibrio diazotrophicus>>, we exposed <<P. miniata>> larvae to <<V. diazotrophicus>> and monitored the cellular immune response over time using <<in vivo>> time lapse microscopy as well as changes in gene expression. Preliminary results indicate that, in response to bacterial infection, sea star larvae upregulate orthologs of proteins involved in the vertebrate complement system. Furthermore, morphological changes in the coelomic pouches may suggest immune cell proliferation during the course of infection. Future work will investigate the larval response to additional marine pathogens isolated from adult sea stars. This work aims to reveal fundamental aspects of the echinoderm immune systems and, more broadly, animal immunity.

Title: Plant hormone cytokinin regulates chloroplast function and leaf senescence in Arabidopsis thaliana

Primary Author: Risheek Rahul Khanna

Additional Authors: Aaron Rashotte;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Leaf development terminates with senescence that is marked with reduced chlorophyll accumulation - popularly known as “fall colors”. Senescence progression is regulated by abiotic stress exposure or by internal factors like plant hormones. Cytokinin (CK) is a hormone that functions to delay senescence by maintaining photosynthesis and altering chloroplast (organelle) functionality. Here we used a modified dark-induced leaf senescence bioassay to examine CK treatment effects towards salinity exposure senescence and chloroplast activity. Utilizing Arabidopsis CHLOROPLAST IMPORT APARATUS2 (cia2) mutant lines - exhibiting altered chloroplast assembly, this study reports physiology and gene expression findings in senescence. Results indicate that salt stress reduces photosynthesis performance accelerating leaf senescence while CK treatment delays it by maintaining higher chlorophyll levels and biological membrane integrity. RNA-seq was performed to identify differentially expressed genes following CK treatment that act to regulate senescence. Results show that CK-metabolism and signaling genes were highly induced across untreated and salt stress senescence. Using WGCN analysis, genes that show significant coexpression trends across senescence progression with known photosynthesis and CK-related genes were identified, with CIA2 being one such candidate. cia2 mutant plants were evaluated using image-based growth phenotyping - indicating that loss-of-function in the gene results in accelerated senescence and reduced sugar accumulation. CK treatment failed to maintain pigment content and membrane integrity in senescing cia2 leaves – highlighting CIA2 as a potential hub for CK mediated antisenescence effects. Overall, this study indicates the mechanisms through which leaf functioning can be prolonged and senescence delayed. This knowledge can be crucial in engineering for improved yield in plants especially those challenged with stressful conditions.

Title: Implementing design principles to improve scientific communication and modeling, via game board development

Primary Author: Robert Gleason

Additional Authors: Devon Ward;Davide Guzzetti;Rehman Qureshi;

Department/Program: School of Industrial and Graphic Design

College: College of Architecture, Design and Construction

Abstract: While the disciplines of science and visual communication are often relegated to their own fields, interdisciplinary collaboration can result in modeling tools with a higher standard for public engagement. For modeling tools to be effective in the public sphere, visual communication principles need to be more thoroughly integrated into the initial stages of development. To resolve this missed opportunity, this article presents three visual communication principles—visual hierarchy, color accessibility, and informational constraints—and presents one modeling tool, in the form of an educational board game, as a case study to understand the significance of their application. The board game at hand, Satellite Tycoon, is a modeling device used to evaluate the balance between market penetration and space sustainability in a publicly accessible format. Through an iterative set of play tests, visual communication principles function as variables to improve the model's effectiveness. In practice, the application of design principles to Satellite Tycoon led to numerous visual changes that emphasize essential game features, clarify the relationship between game pieces, and remove extraneous information. Collectively, these communicative changes improved ease of adoption and reduced playtime, making the modeling tool accessible to a wider public while maintaining informational complexity. Such successes in the interdisciplinary collaboration between science and visual communication can act as a precedent for continuing interdisciplinary collaborations.

Title: High throughput stochastic rare event buckling analysis of lattice structures

Primary Author: Robert Hudson

Additional Authors: Shafi Shahriar;Logan Gotwalt;Wen Luo;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: Lattice structures are widely used in aerospace applications, such as rockets, deployable space structures, and reusable, crewed spacecraft, due to their exceptional strength-to-weight efficiency, enabling lightweight yet high-performance designs. Among these, cylindrical lattice shells are the most prevalent type. However, their thin-walled design makes them highly susceptible to buckling and extremely sensitive to geometric imperfections. This means that their strength can vary significantly depending on random manufacturing defects. A relevant study on cylindrical shell buckling behavior, NASA SP-8007, has roughly 500 data points sourced from various institutions gathered over 20 years in cylindrical shell buckling. However, the data applies exclusively to continuous solid shells and does not account for the behavior of lattice shells. How can we efficiently gather data on the buckling load distribution of cylindrical lattice shells to reliably predict rare-event failures? To collect data swiftly, a novel high-throughput testing machine was developed to enable testing multiple samples in one go. The high-throughput testing machine connects all the samples in series where every sample experiences the same compression. Once a sample has buckled, columns adjacent to the sample will transmit the compressive load to the remaining samples, allowing them to buckle one by one according to the ascending order of strength. To generate samples rapidly, SLA additive manufacturing was utilized to efficiently make multiple samples in a single print and the high resolution for producing the imperfections of interest. Currently, the maximum number of samples per test is 20. With this method, reaching the failure risk level of one-in-a-thousand requires only one month. The huge data sets will allow the design of similar structures in aerospace have a higher reliability and mission success rate.

Title: Embedding-based sequence alignment using clustering and double dynamic programming

Primary Author: Robert Spicer

Additional Authors: Sai Prashanthi Pallati;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Accurate detection of protein sequence homology is essential for understanding evolutionary relationships and predicting protein functions, particularly for low-homology proteins in the "twilight zone" (<30% sequence identity). Traditional sequence alignment methods often fail in these cases, and while AlphaFold2 has revolutionized protein structure prediction, its applicability is limited by the vast gap between known protein sequences and predicted structures. Metagenomics datasets alone reveal billions of unique protein sequences, with only a fraction having experimentally determined or reliably predicted structures. Additionally, AlphaFold2's high computational cost often requires hours or even days for large-scale analyses. To address these challenges, we propose a novel embedding-based sequence alignment approach that leverages residue-level embeddings from pre-trained protein language models (e.g., ProtT5, ESM-1b). Our tool integrates clustering and double dynamic programming to achieve Spearman correlation coefficients of up to 0.93 (TM-min), outperforming existing embedding-based tools, and completes alignments in seconds, offering a scalable and efficient solution for bioinformatics applications. My research addresses critical gaps in detecting protein sequence homology, particularly for low-similarity proteins in the "twilight zone" (<30% sequence identity), by introducing an embedding-based sequence alignment approach. This innovative approach not only overcomes scalability issues associated with AlphaFold2 but also extends bioinformatics capabilities, enabling efficient and accessible analysis for large-scale protein sequence datasets.

Title: H9Nx avian influenza viruses: tissue susceptibility and immune response in chicken embryo-derived primary cells

Primary Author: Rocio Gerez Miranda

Additional Authors: Miria Ferreira Criado;James Krehling;Mariana Andrioli Pinheiro;Diego Ernesto Ventura Urbina;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: The H9 subtype of Avian Influenza Virus (AIV) is the most prevalent low pathogenic avian influenza virus (LPAIV). While wild waterfowl are their natural reservoir, these viruses can infect various species, including humans, posing significant threats to poultry industries and public health. This study evaluated tissue susceptibility, viral replication dynamics, and immune responses to H9Nx AIV strains isolated from chicken (H9CK), turkey (H9TK), ruddy turnstone (H9RT), and wood duck (H9WD) in primary cell cultures from chicken embryo tissues—fibroblast (CEF), kidney (CEK), lung (CELu), liver (CELi), trachea (CET), and duodenum (CED). Cells were infected at a multiplicity of infection (MOI) of 0.1, with samples collected daily for seven days post-inoculation (dpi). Infection susceptibility was assessed via cytopathic effects (CPE), viral titers (Real-Time RT-PCR and TCID50 assays), and immunofluorescence. Cytokine expression analysis included IFNα, IFNβ, IFNγ, IL-1β, IL-4, IL-8, IL-10, IL-12, IL-18, and TNFα. CPE was observed for most strains, and immunofluorescence confirmed virus-cell protein co-labeling, indicating tissue specificity. CEK and CET showed extensive cell susceptibility, while CEF and CED were more resistant. H9CK and H9TK exhibited high level replication, with viral titers exceeding 5 Log10/ml. TCID50 assays confirmed production of infectious particles particularly in CEK for all strains. Cytokine expression profiles varied significantly by cell type and dpi, highlighting diverse tissue-specific immune responses. This study demonstrates that H9Nx AIV strains exhibit distinct tissue tropism and immune response dynamics in chicken embryo-derived cell cultures, providing insights into the pathogenesis and virus-host interactions of H9 AIV strains.

Title: Feedstock effects of woody biochar adsorbents for lead ion removal from aqueous solutions

Primary Author: Ruiqi Li

Additional Authors:

Department/Program: Administration Forestry and Wildlife Sciences

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's 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 its feedstock. This study systematically 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, surface functional groups, and mineral content (e.g., 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 optimize heavy metal remediation. This study provides actionable insights for designing cost-effective, feedstock-specific biochar to address lead contamination in aquatic environments.

Title: A Hybrid Kinematic and Machine Learning Approach to Future Joint Angle Estimation at the Ankle

Primary Author: Ryan Pollard

Additional Authors: Michael Zabala;Ivan Enrique Nail Ulloa;Jaxie Brokamp;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Machine learning-based joint angle estimation algorithms are commonly used to align the kinematic trajectories of wearable assistive devices and their operators. In warfighter applications, minimizing estimation error while deploying fewer sensors is critical to ensure rapid donning/doffing of wearable assistive technology in remote and demanding environments. However, deploying a reduced sensor count imposes limitations on the accuracy of these machine learning-based models. Therefore, developing additional, biomechanically meaningful input parameters from these sensors and subsequently informing joint angle estimation models with these features may further reduce model error for limited sensor applications. Thus, this study explored the effects of including simple, kinematically extrapolated joint angle estimations as Random Forest model input features when using only historical sagittal ankle angles to predict future ankle angles. Results indicated that including $N \geq 1$ KE estimations significantly reduced the joint angle estimation error of the Random Forest models across a variety of estimation horizons without meaningfully increasing the model runtime for exoskeleton applications ($N = 0$: $t_{run} = 1.89$ ms; $N = 25$: $t_{run} = 2.91$ ms). Near future horizons ($t_{hzn} = 50 - 100$ ms) only saw increased benefit from a small number of KEs, while larger estimation horizons ($t_{hzn} = 200 - 250$ ms) saw benefit from the inclusion of higher counts of KEs. Such results indicate that this simple methodology may be implemented into some single sensor ankle exoskeleton applications to reduce model error without meaningfully increasing computational demand. The improved performance of the hybrid model can be visualized as a “temporal convergence” of the HJK sliding window and an “error reduction convergence” of consecutive, increasingly accurate KE estimations towards the actual future angle.

llerTitle: Spatial and Temporal Distribution of Microplastics in Alabama River

Primary Author: Safeerul Islam Hashmi

Additional Authors: Tham Hoang;Andrew Barrick;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Rapid increase in plastic pollution has received increasing attention in recent decades. Proper stewardship requires a strong understanding of the severity of pollution and accompanying environmental consequences. Characterizing the abundance, distribution, and transportation of microplastics in water systems is necessary for proper stewardship. Globally, there are ongoing efforts to quantify the severity of microplastic pollution (MP) in river waters and sediments. In the United States several studies have been conducted however nationally, the scope of the “microplastic problem” is unclear, with Alabama’s water systems being no exception. The aim of the present study was to evaluate the presence of microplastics in the Alabama River. Seasonal sampling campaigns (summer, fall, winter, and spring seasons) collected water samples at 5 selected sites (Wetumpka (upstream), Dixie landing, Selma, Montgomery, and Mobile Bay (downstream) to identify the presence and abundance of microplastics. Different physical characteristics including size, shape, polymer and density were determined . The study identified that the number of fragments was higher than the number of fibers for most seasons. Mobile and Selma had the highest number of MPs compared to the other three sites. The highest number of MPs was found during Summer, with approximately 150 particles/L at Mobile and Selma the with lowest numbers recorded in Winter, with approximately 11 particles/L at Dixie Landing. The study provides a first look at MP pollution in Alabama’s river systems. Follow-up ecotoxicity studies are needed to investigate potential ecosystem consequences of microplastics found in the Alabama river system.

Title: Improving the performance of low-grade waste gasification in a fluidized bed using a machine-learning approach

Primary Author: Sagar Kafle

Additional Authors: Sushil Adhikari;Surendar Moogi;Ashish Bhattarai;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Increasing demand for sustainable energy sources and environmental consequences demand the proper utilization of low-grade waste, such as pine residue, organic fraction of municipal solid waste, and legacy coal. Fluidized bed gasification is one promising pathway for producing syngas from such feedstocks, but it is very sensitive to feedstock characteristics and operating conditions. However, despite much progress, there remains a critical challenge in the prediction of the gasifier performance of such low-grade wastes. This work presented herein attempts to fill this knowledge gap by integrating machine learning (ML) techniques for modeling and optimizing gasification in a fluidized bed reactor. Data were gathered from the literature using a systematic review approach to train the ML models. A total of 105 from Scopus and 107 from Web of Science were assessed, developing the search strategies, which then merged using Mendeley and removed 100 duplicate files, and 112 studies remained. Articles were further screened by developing inclusion and exclusion criteria, removing 15 articles from the title and abstract screening, and 8 articles from skim reading; the remaining 89 articles' data were extracted and used for the study. The validation is done using both literature and experimental data. A total of 14 experiments were conducted in a lab-scale fluidized bed reactor. The linear, random forest, extreme gradient boosting, and support vector models were developed and tested. The developed ML approach optimizes the gasifier performance and helps valorize the low-grade waste toward a circular economy in their use for sustainable energy production.

Title: A deep learning framework for scalable protein structural similarity search from sequences

Primary Author: Sai Prashanthi Pallati

Additional Authors: Robert Spicer;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Protein sequence similarity has traditionally been the primary approach for identifying evolutionary relationships and functional annotations. However, this method is often limited when dealing with remote homologs with low sequence similarity (<30%), where structural information provides a more reliable metric for assessing protein relationships. Existing structural alignment tools require either experimentally determined structures or computationally intensive structure predictions, making large-scale (e.g., metagenomic) structural similarity searches challenging. Our work introduces a deep learning-based approach that enables the prediction of structural similarity scores directly from sequence pairs. The model is trained using a twin neural network architecture to approximate structure-based alignment scores, allowing for efficient indexing, and querying of large protein sequence databases. By transforming protein sequences into vector representations that encode structural features, our approach facilitates rapid structural similarity searches without the need for explicit structure computation. Our method significantly improves sensitivity in detecting remote homologs compared to traditional or recent AI-based sequence alignment techniques. Benchmarking on multiple protein structure databases demonstrates that it achieves high accuracy in predicting structural similarity, even for proteins with minimal sequence identity. Additionally, our approach scales efficiently, allowing for rapid and accurate searches across large protein sequence datasets. The results highlight the effectiveness of this method in enhancing structural annotation and remote homology detection, providing a scalable solution for large-scale protein sequence analysis.

Title: Developing frost-tolerant Southern highbush blueberry cultivars for Alabama

Primary Author: Sakshi Pathania

Additional Authors: Sushan Ru;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Blueberry is the second major fruit crop in Alabama, followed by peach. However, blueberry production in Alabama is marginal compared to neighboring states such as Florida, Georgia, and North Carolina. Alabama growers still rely on old rabbiteye cultivars due to a lack of access to southern highbush blueberries (SHB) that are adaptable to the region. SHBs are valued for their early maturation and fruit quality but have not been widely adopted in Alabama due to their susceptibility to spring frost and other possible biotic or abiotic stresses. This project aims to introduce frost-tolerant SHB cultivars in Alabama through multi-environment cultivar evaluation. A total of 12 cultivars and 25 advanced selections of SHB have been evaluated in two locations in Alabama: the E.V. Smith Research Center (EV) in Central Alabama and the Brewton Agricultural Research Unit (BW) in South Alabama. Plants have been evaluated for 50% bloom, average berry weight (g), yield per plant (g), Brix (%), titratable acidity (TA%), and firmness (g/mm). Data from 2024 revealed that San Joaquin (5,035 g) and NC5289 (3,798 g) had the highest average yield at EV. At BW site, TH-2976 (3,375 g) and NC5289 (2,984 g) showed the highest yield. Colossus and Patrecia produced the largest average berry weight for both locations. In the BW, Colossus had an average berry weight of 4.72 g and Patrecia 3.8 g. At the EV location, both Colossus and Patrecia had an average of 3.0 g berry weight. For Brix, FL12-213A (14.7) and NC5326 (14.2) had the highest values at EV, while NC5326 (14.2) and Sentinel (13.8) had the highest values at the BW location. Overall, late-blooming selections such as NC5314 and NC5289 were identified as more suitable for Alabama to mitigate spring frost damage. The frost-tolerant cultivars identified through this project will significantly benefit small to mid-sized growers in Alabama by ensuring stable fruit production.

Title: Headspace analysis of cell culture-cultivated Channel Catfish Virus (CCV) and odor transfer to polymer-based canine training aids for biological detection

Primary Author: Samantha Hagerty

Additional Authors: Melissa Singletary;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: The highly advanced canine olfactory system has long been employed for odor detection, including recently expanding applications in surveillance of biological threats and diseases. However, working with infectious agents presents unique training challenges due to limited accessibility of restricted source material outside of controlled facilities. Previous work demonstrated the ability of polymer-based odor capture and release (POCR)™ training aids to absorb and deliver a true odor profile of virally infected cellular matrix without genetic contamination. While the POCR™-based system has been evaluated for training, we aim to characterize the volatile organic compound (VOC) profile associated with biological targets of interest and understand how odor absorption and sterilization processes required for operational use affects the headspace presented to working dogs. Here, proton transfer reaction-mass spectrometry (PTR-MS) is used for direct comparative headspace analysis of oocyte-cultivated viral target, Channel Catfish Virus (CCV, 6.25 x 108 CCID50/ml), in aqueous and polymer-absorbed form. Odor-charged POCRs™ were further analyzed after a rigorous autoclave protocol necessary for potentially hazardous biomaterials. Lysate collected from CCV-infected and healthy control oocytes were analyzed and the extracted ion chromatogram revealed unique peak signatures including compounds related to oxidative stress responses. Analysis of the training aids after a standard 24-hour charging process demonstrated effective transfer of the odor signature which persisted after autoclaving. While target peaks were present, sterilization resulted in a significant increase in polymer-specific background volatiles which may influence discrimination. This work characterizes the volatile emissions from CCV-infected cell culture and demonstrates effective odor absorption of POCR™ training aids that withstands sterilization.

Title: Analyzing carbonate rock samples in the context of geological carbon sequestration

Primary Author: Samantha Mariano

Additional Authors: Lauren Beckingham;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Geologic carbon sequestration is an up-and-coming method that works to reduce atmospheric carbon dioxide emissions by capturing carbon dioxide (CO2) and securely storing it in deep subsurface rock formations over the long term. The goal is to sequester CO2 in an aqueous or solid form so it cannot re-enter the atmosphere. A carbonate dolomite sample sourced from the Cassville reservoir in Cassville, GA 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 a different color. 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 the mineral phases present in the carbonate sample. Additionally, X-ray Computed Tomography (CT) scans are reconstructed to capture the three-dimensional pore structure of the rock, providing insights into the distribution and connectivity of the pores within the sample. These pore networks are used to evaluate the storage capacity and permeability of the rock, which are key in assessing its potential for capturing and storing CO2 in geological sequestration applications. By integrating data from SEM and CT imaging, this research contributes to a comprehensive understanding of the carbonate formation, offering a foundation for future investigations into its use in mitigating atmospheric carbon dioxide levels. The results of this study aim to enhance the development of more effective and reliable carbon sequestration strategies in geological formations. <<This project is 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: Unlocking the ocean's medicinal potential: Exploring marine derivatives as therapeutics for COPD

Primary Author: Samantha Smith

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Chronic obstructive pulmonary disease (COPD) is a condition that affects more than 200 million people worldwide. It has become the sixth leading cause of death in the United States. Smoking is a leading cause, as well as pollutants from industries. COPD causes inflammation and narrowing of the airways, mucus buildup, fibrosis, and damaged alveoli. These symptoms make it difficult to breathe and make them prone to coughing. COPD can also cause complications like pneumonia, hypercapnia, hypoxemia, and collapse of the lungs. The current treatments include bronchodilators, corticosteroids, lung volume reduction surgery, and bronchoscopic lung volume reduction, causing severe to moderate adverse effects that include tremors, muscle weakness, weight gain, collapsed lungs, pneumonia, heart attacks, nausea, diarrhea, and strokes. The urge to look for alternative medicines arises from adverse reactions as well as the inefficiency and lack of selectivity of synthetic medication methods. Recent research has concentrated on marine natural bioactives, owing to their potent pharmacodynamic properties and barely or nonexistent adverse effects. Hence, the current study focuses on marine bioactives can be an impactful therapeutic for preventing, reducing the rate of progression, and treating COPD. A literature search was done on PubMed, Google Scholar, and Scopus databases using keywords such as: “COPD,” “Marine Bioactive,” “Marine Derivatives,” and “Marine Compounds.” Few marine derivatives have been shown to have both preventative and therapeutic effects on COPD, including Fucoxanthin, Apo-9’-fucoxanthin one, Black Coral Extract, Brevenal, Astaxanthin, and Resolvin D1 with minimal adverse effects.

Title: Vaccination of plants for general disease resistances: a novel perspective on the 30 years of discovery

Primary Author: Samia Samin

Additional Authors: Sang Wook Park;Kathy Lawrence;Simrandeep Kaur;Ashna Adhikari;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Pathogen attack is a major threat that restricts plant growth and yield. Over decades, many studies have identified a large pool of resistance (R) genes as potential elements to focus on for crop improvement. Unfortunately, genetic engineering of plants modifying these R genes to overcome disease constraints appears to be at a standstill. Their ectopic expressions tend to confer protection against just one or a few pathogens, while suppressing critical aspects of plant growth and productivity. To search for novel and feasible approaches to engineer disease resistances, several studies including ours have highlighted "plant growth-promoting rhizobacteria (PGPR)-induced systemic resistance (ISR)" as a unique mechanism capable of priming long-lasting, broad-spectrum disease resistance without the growth penalty that usually accompanies the resistance. Hence, leaders in plant pathology have repeatedly identified 'the understanding of ISR' as a major future challenge, especially "what is the mobile signal(s)?", and this is answered in this study. We show that PGPR trigger the accumulation of jasmonate (but not salicylate) hormones in the inoculated roots and send 12-oxo-phytodienoic acid (OPDA, a primary jasmonate precursor) as a phloem-mobile signal to the uninoculated leaves where it bind/activate a receptor (CYP20-3)-dependent OPDA signaling. OPDA signaling then induces and stimulates GRX480/ TGA transcriptional factor systems in actuating both OPDA and salicylic acid signaling, which together sensitizes ISR. To extend these results, we are performing grafting studies using different combinations of wild type and/or cyp20-3 KO mutant rootstocks (RS) and scions. This will confirm that CYP20-3 is required to respond to the ISR signal in the systemic scions but is not required in the inoculated tissues to produce the ISR signal, and—to the end—help generating transgenic plants with enhanced biotic stress resistance while maintaining or even improving growth and yield.

Title: Gender inequality and women’s health and well-being in developing countries: the moderating role of socioeconomic status

Primary Author: Samia Sultana

Additional Authors: Thomas Fuller-Rowell;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: An established literature suggests an inverse association between gender inequality in the labor market and women’s health and well-being such that women’s health tends to be poorer in countries with greater gender disparities in labor force participation. However, no study has examined whether country-level measures of gender inequality are more strongly associated with health among less advantaged SES groups. To address this gap, this present study will be the first to investigate the interactive effect of country-level Gender Inequality in Labor Force Participation (GILFP) and household income on women’s health and well-being in developing countries. Data from the World Values Survey (2017–2022) included 33,822 women from 45 developing countries and were merged with primary sources of the Gender Inequality Index 2021 to assess the impact of GILFP on women's self-assessed health and life satisfaction across income groups. Results showed that GILFP was a significant predictor of women’s life satisfaction but not a significant predictor of self-reported health status. Women from low- and middle-income households had lower odds of reporting good health and lower life satisfaction compared to those from high-income households. Finally, results indicated that the interaction between GILFP and household income was significant or marginally significant, moderating the association such that women from low-income households in countries with high labor force inequality reported significantly lower odds of good health <<B = -0.11, SE = 0.04, p = .012>> and lower life satisfaction <<B = -0.233, SE = 0.121, p = .054>> compared to those in countries with low labor force inequality. This pattern was similar for women from middle-income households, whereas women from high-income households appeared protected from the negative effects of high labor force inequality. Findings highlight the need to consider socioeconomic status in research on gender inequality and women’s health

Title: The effects of phosphoprotein expressed in astrocytes 15kDa (PEA15) loss of function on metabolic phenotype and glucose uptake

Primary Author: Samira Salimiyan

Additional Authors: Emily Graff;Rie Watanabe;Angela Vines;Taylor Towns;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Phosphoprotein enriched in astrocytes-15kDa (PEA15) is ubiquitously expressed in all tissues, with highest expression in the brain and functions as is an intracytosolic adaptor protein that regulates cellular apoptosis and proliferation. PEA15 also influences glucose metabolism, specifically through binding phospholipase D1 (PLD1) and blocking glucose transporter translocation. PEA15 expression is increased in patients with obesity and type 2 diabetes (T2DM), and transgenic animal models that over express PEA15 develop insulin resistance; however, there is limited information on the effects of PEA15 loss of function on energy metabolism and glucose uptake. The aim of this study is to determine if PEA15 loss of function alters the metabolic phenotype in vivo and to assess changes in glucose uptake in vitro. We hypothesize that loss of PEA15 function will disrupt the metabolic phenotype in vitro and increase cellular glucose uptake. Male and female global PEA15 knockout (KO) mice and their wild-type (WT) littermate controls were evaluated for differences in body composition and metabolic parameters over a 20-week period. Glucose uptake was assessed in primary fibroblasts from WT and KO mice to assess potential mechanisms. No significant differences in metabolic parameters were observed. In primary fibroblasts, glucose uptake was significantly increased in KO compared to WT fibroblasts. These findings suggest that, under resting metabolic conditions, there is no overt metabolic phenotype in KO mice despite changes in cellular glucose uptake. Future studies will include evaluation under conditions of metabolic stress, such as fasting and obesity to identify potential compensatory mechanisms. Additionally, we will investigate interactions in PLD1 and GLUT4 translocation. Findings from these studies will allow us to better understand the fundamental role of PEA15 in glucose homeostasis and how changes in PEA15 can impact metabolic health.

Title: Reproductive traits and testis transcriptome analysis reveal age-related changes in reproductive performance in male blue catfish, Ictalurus furcatus

Primary Author: Samitha Liyanage

Additional Authors: Ian Butts;Luke Roy;Xu Wang;Rex Dunham;Timothy Bruce;Alexandra Nowicki;Kyle Wood;Kaylan Martin;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Catfish farming is the largest aquaculture industry in the U.S, accounting for ~70% of total finfish aquaculture production. At present, the hybrid catfish, produced by crossing channel catfish (Ictalurus punctatus) females with blue catfish (I. furcatus) males, constitutes >50% of the harvest. Typically, older blue catfish (≥5 years) are selected for artificial fertilization. Observations at our facilities and reports from hatcheries indicate a high degree of variation in reproductive performance among individuals. Thus, it is essential to establish links between paternal age and reproductive success, as it is apparent that advanced paternal age leads to changes in reproductive performance. This study investigated reproduction of blue catfish males aged 2 to 10 years, focusing on key reproductive parameters. A total of 103 males were sampled, representing 9 age classes. Morphometric data were collected, and blood was drawn to quantify testosterone (T), 11-ketotestosterone (11-KT), osmolality, and ions. Histological images of testis assessed stages of spermatogenesis and sperm were activated for kinematic analysis. Testis transcriptome was also profiled across four distinct ages, 2,4,7 and 9. Results revealed that paternal age had an impact on reproductive performance with several key findings, which now advances our male diagnostic toolbox. Sperm were detected in 13%, 64%, and 100% of males at 2, 3, and 4+ years of age, respectively. Sperm production was affected by age ($P < 0.0001$), with the highest production at Age 6. Circulating T and 11-KT levels increased to Age 6 and then showed a decreasing trend. Transcriptomics identified 5220 differentially expressed genes in all comparisons. The highest number of gene expression changes were identified at Age 7 with 2,261 downregulated and 1,824 upregulated genes. Together, these data are paramount for designing studies to manipulate and control testes development to enhance catfish production efficiency.

Title: Comparison of southern highbush blueberry cultivars grown in high tunnels and open fields

Primary Author: Samjhana Wagle

Additional Authors: Elina Coneva;Bernardo Chaves-Cordoba;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Southern highbush blueberry (SHB) cultivars are susceptible to spring frost damage, which can impact yield and fruit quality. Alternative production systems, such as high tunnels, offer protection against frost and may enhance SHB production. This study evaluated the performance of three SHB cultivars ('Meadowlark', 'Victoria', and 'Jewel') under high tunnels (HTs) and open fields (OFs). Stomatal conductance (SC), stomatal density (SD), fruit quality, and quantity were measured, and weather variables were recorded. Data were analyzed using Proc Glimmix and Tukey's HSD test applied for mean separation ($p \leq 0.05$). SC varied significantly by cultivars ($p < 0.001$) and production systems ($p < 0.001$), with higher SC observed in OFs. 'Meadowlark' exhibited the highest SC followed by 'Jewel' and 'Victoria'. SD was significantly influenced by the production systems and leaf stage ($p < 0.001$), with young leaves in OFs having the highest SD. Cultivars also affected SD ($p = 0.0379$), with 'Victoria' showing the highest SD in young leaves, followed by 'Meadowlark' and 'Jewel'. The yield was higher in HTs across all cultivars, with 'Victoria' producing the highest yield followed by 'Jewel' and 'Meadowlark'. Single berry weight was significantly affected by both cultivars and production systems ($p = 0.0004$), with 'Meadowlark' and 'Victoria' producing larger berries in HTs, while 'Jewel' had the smallest fruit in both systems. Brix levels were cultivar dependent ($p = 0.0005$), with 'Meadowlark' exhibiting the highest values. Firmness was influenced by cultivars ($p < 0.001$) and production systems ($p < 0.001$), with greater firmness observed in HTs. 'Meadowlark' had the highest firmness, while 'Jewel' had the lowest. In conclusion, HTs improved yield, berry weight, Brix, and firmness in SHB cultivars. 'Victoria' demonstrated superior yield performance, while 'Meadowlark' produced the highest fruit quality, particularly in terms of Brix and firmness.

Title: Novel LXR-beta agonist promotes myelin repair and restores neural integrity in frontotemporal dementia.

Primary Author: Sampada Tamhankar

Additional Authors: Rajesh Amin;Meenakshi Singh;Ian Steinke;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: More than 50% of sporadic Alzheimer's disease (AD) patients carry the ApoE4 allele, which disrupts cholesterol trafficking in the brain. This imbalance harms oligodendrocytes, the cells that produce myelin, leading to myelin damage—a key factor in Frontotemporal Dementia (FTD). Currently, no clinically approved therapies exist to address cholesterol imbalance in FTD brains. The Nuclear Receptor- Liver X Receptors (LXRs) play a crucial role in regulating cholesterol metabolism and energy balance in the brain, making them promising targets for FTD treatment. However, existing LXR agonists have failed to advance clinically due to adverse effects such as hepatotoxicity and neutropenia caused by LXR-alpha activation. Few studies have explored the potential of selective LXR agonists to prevent the progression of FTD to AD-related dementia (ADRD). Our study explores the therapeutic potential of targeting LXR-beta to promote myelin repair in FTD. We developed a novel LXR-beta agonist, AU403, designed to enhance myelination in the central nervous system (CNS) while reducing the side effects associated with existing LXR agonists. Through this study, we identified and addressed myelination deficits in both 5XFAD transgenic mice and MO3.13 oligodendrocyte cell lines. AU403 treatment significantly increased the expression of myelination markers in MO3.13 cells, surpassing the effects of the known LXR agonist GW3965. Protein expression was validated through immunoblotting, confirming the enhanced expression of myelin-related biomarkers. In 5XFAD mice, AU403 treatment reversed myelin deficits and restored neuronal integrity, as demonstrated by histological staining and densitometric measurements of dendritic spines. These findings establish AU403 as a promising therapeutic candidate for mitigating myelination deficits and neurodegeneration, with future investigations focusing on elucidating the mechanisms by which LXR activation counteracts FTD - related pathologies.

Title: Enabling virtual reality augmented hybrid exoskeletons

Primary Author: Samuel Yount

Additional Authors:

Department/Program: Electrical and Computer Engineering

College: Samuel Ginn College of Engineering

Abstract: Millions of people worldwide are affected by neurological conditions (NC), which degrade their quality of life. NCs affect the brain, spinal cord, or nervous system. This impacts the quality of life, cognitive function, and physical abilities of those afflicted. The secondary effects of the loss of motor control and muscular strength include obesity, chronic pain, and other long-term conditions. Recreational exercises can offer some relief to these symptoms as well as improve mobility and overall health. However, individuals with NCs may lack the necessary strength and limb control to effectively benefit from these exercises. Functional electrical stimulation (FES) has been shown to stimulate muscles and, when used in conjunction with rehabilitation robots, can provide more effective training for targeted muscles. Virtual reality (VR) is increasingly being deployed in applications related to recovery and rehabilitation, offering engaging environments that can enhance the rehabilitation process. The hybrid exoskeleton, designed for repetitive arm and shoulder movements, will feature two degrees of freedom, allowing for elbow bending and shoulder rotation. The device will be equipped with FES to promote muscle development and motor control. Participants will use the hybrid exoskeleton within various VR scenarios, performing actions such as arm flexion and extension. The VR environments will be designed to prevent fatigue and maintain high levels of engagement, thereby enhancing the effectiveness of the rehabilitation process. Performance data will be collected and analyzed to assess improvements in motor function and endurance over time. Although the VR-integrated hybrid exoskeleton is still under development, this research aims to establish a foundation for future studies that will evaluate its potential to improve rehabilitation for individuals with NCs.

Title: Assessing the impact of oak wilt on red oaks using species distribution models

Primary Author: Sandeep KC

Additional Authors: Hammad Ud Din;Rajesh Dahal;Chen Ding;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Oak trees, keystone species in many North American ecosystems, face increasing threats from oak wilt, a devastating disease caused by the fungal pathogen Bretziella fagacearum. Among various oak species, red oaks (Quercus rubra, Quercus falcata) are the most susceptible to this disease. Oak wilt is emerging as a future threat along with potential new and/or emerging (exotic) pathogens or pests in the forests in the USA. However, it is unclear how the host and pathogen suitable habitats will respond to future environments. Here we assess the biotic stress on oaks due to oak wilt and the current and future distribution of oak wilt under various climate scenarios. We employ species distribution models (SDMs), e.g., MaxEnt and Random Forest, to integrate occurrence data for red oak species and oak wilt with various climatic variables. Environmental predictors are carefully selected to minimize multicollinearity through variance inflation factors (VIF) and correlation analyses. Multiple climate scenarios will project potential shifts in suitable habitats for the host and pathogen. The performance of SDMs is evaluated using matrices, i.e., Area under curve (AUC), and overall accuracy (OA). The outputs can inform the researchers and landowners by highlighting regions where oak habitats may overlap with high-risk areas for oak wilt for proactive management strategies, aiding in conservation efforts and disease mitigation to protect oak-dominated ecosystems.

Title: Confidence in Love: How Relationship Efficacy Shapes Adolescents' Relationship Satisfaction.

Primary Author: Sandra Anti Eyiah

Additional Authors: Francesca Adler-Baeder;Adrienne Marks;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Relationship efficacy, defined as the belief in one's capability to successfully navigate and maintain interpersonal and intimate relationships, impacts individuals' behaviors. Research indicates that a well-established sense of relationship efficacy promotes positive relationship dynamics such as healthy communication and conflict resolution, ultimately enhancing relationship satisfaction. According to literature, relationship satisfaction reflects how individuals gauge their emotional connection and overall fulfillment within their relationship. High satisfaction is characterized by positive feelings and attitudes toward a partner, while dissatisfaction arises from unmet needs or negative experiences. Few studies have examined the role of relationship efficacy in romantic satisfaction during adolescence. Moreover, existing research has largely overlooked how relationship efficacy might predict relationship satisfaction across different sexes during this developmental period. This study aims to address these gaps by exploring whether relationship efficacy influences relationship satisfaction, with sex as a potential moderating factor within an adolescent sample.

Title: Interventions for improving the uptake of preventive medication treatments for breast cancer: A systematic review

Primary Author: Sara Jaradat

Additional Authors: Jingjing Qian;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Preventive medication treatments are effective in reducing the risk of breast cancer, but the uptake of such medication treatments for primary breast cancer prevention remains suboptimal, often below 5%. This systematic review evaluated the effectiveness of various interventions designed to improve the uptake of preventive medications for breast cancer high risk population. We systematically searched MEDLINE, Web of Science, and PsycINFO databases for clinical trials and observational studies that evaluated the impact of interventions on various preventive medication treatment uptake among populations with high risk for breast cancer from inception to October 27, 2024. Of 863 publications identified, 734 abstracts were screened after removing duplicates, and 11 full-text articles that met the inclusion criteria were included in the review. Three studies (27%) evaluated the web-based Guide to Decide (GtD) decision aid intervention which significantly empowered the participants to make informed decisions by increasing their understanding of medications benefits and risks. Two studies (18%) found that the RealRisk decision aid intervention increased knowledge and decision quality regarding breast cancer risks and chemoprevention. Personalized interventions such as decision support systems (DSS) and personalized polygenic risk scores (PRS) significantly improved knowledge, decision satisfaction, and activated clinical discussions about chemoprevention. Only PRS increased uptake of endocrine therapy in high-risk women. Other interventions, including tamoxifen education sessions did not substantially incline participants to consider tamoxifen, possibly due to adverse effects concerns. Protection Motivation Theory (PMT) tools modestly increased intentions for preventive medications. Interventions aiming to improve the uptake of preventive medication treatments for breast cancer consistently improved knowledge and decision-making but resulted in low uptake of treatments.

Title: Clofazimine treatment targets key non-coding RNAs associated with tumor progression and drug resistance in lethal prostate cancer

Primary Author: Sarah Batten

Additional Authors: Suman Mazumder; Dr. Amit Mitra

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Prostate cancer (PCa) is the most commonly diagnosed cancer and the second-leading cause of cancer death among men in the United States, representing 24.3% of all new cancer cases in the U.S. Metastatic castration-resistant prostate cancer (mCRPC) is a lethal variant of prostate cancer that is associated with increased aggressiveness, cancer stemness, morbidity, and the risk of developing into taxane drug-resistant PCa. As taxanes are currently the first-line chemotherapeutic agents for mCRPC, there is a critical need to develop novel agents for the treatment of mCRPC. Clofazimine (CLF) is a potential immunomodulator drug that is FDA-approved for the treatment of leprosy. Recently, using a phenotype-based high-throughput drug screening, we demonstrated the in vitro (cell lines), in vivo (mouse xenograft models), and ex vivo (patient-derived primary tumor cells) efficacy of CLF in drug-resistant forms of chronic myeloid leukemia and multiple myeloma. In this study, we demonstrated that CLF is effective as a single agent and in combination with docetaxel (DTX) in a panel of PCa cell lines representing the diversity of CRPC patients. The response to CLF in the PCa cell lines was quantified using in vitro cytotoxicity assays, caspase 3/7 activity assay for apoptosis, cell cycle analysis, and aldehyde dehydrogenase activity assay for cancer stemness. Further, drug-induced changes were investigated using next-generation RNA sequencing analysis, where CLF treatment was found to modulate the expression of several non-coding RNAs that are associated with tumor cell proliferation, cell migration, and PCa drug resistance. Western Blotting was performed to validate the dysregulation of proteins associated with cell death and apoptosis, as well as the top dysregulated pathways in mCRPC following treatment with CLF. Our results support the preclinical development of CLF against aggressive forms of Prostate Cancer and provide additional insights into its mechanism of action.

Title: Characterization of thermodynamic nonequilibrium in gaseous microchannel detonations

Primary Author: Sarang Bidwai

Additional Authors: James Michael;

Department/Program: Aerospace Engineering

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Abstract: Rotating detonation engines and Pulsed detonation engines have received renewed attention in recent years for applications in aerospace propulsion. Numerical thermodynamic models have predicted a nearly 2x gain in thermodynamic efficiency in engines utilizing detonations when compared to traditional Brayton cycle, commonly used in jet engines. However, adequate understanding of the structure of detonation waves is necessary for development of such engines. Thermodynamic equilibrium is a common assumption in most numerical models used to predict the structure of the detonation waves. However, recent studies have suggested a possibility of small degree of thermodynamic nonequilibrium behind the shockwave of a detonation. The shockwave coupled to the detonation provides translational energy to the reactant gases. This excitation is then equilibrated with other degrees of freedom of the molecules in a process commonly known as relaxation. Translational-rotational relaxation is a relatively fast process, requiring 100s of collisions, however, vibrational relaxation is slower process, requiring 1000s to 10000s of collisions. In this study, the rotational and vibrational temperature of molecular hydrogen is simultaneously measured using coherent anti-Stokes Raman spectroscopy. The rotational temperature of hydrogen was found to be within 7% of expected Chapman-Jouguet temperature but the vibrational temperature was measured to be lower than the rotational temperature. This discrepancy in temperature suggests a need to consider thermodynamic nonequilibrium when modeling detonations.

Title: Evaluating drought tolerance of southern highbush and rabbiteye blueberries

Primary Author: Savannah Busby

Additional Authors: Sushan Ru;Tanzeel Rehman;Courtney Leisner;Sajid Hanif;Alvaro Sanz Saez de Jauregui;

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College: College of Agriculture

Abstract: Blueberries (Vaccinium sect. Cyanococcus) are prone to drought due to their shallow root system and limited ability to uptake water from the soil. Previous research has shown rabbiteye (Vaccinium virgatum) blueberries to be more tolerant than highbush varieties (Vaccinium corymbosum L.) to abiotic stresses. However, little is known about their response to drought and whether there are ecotype- or cultivar-specific responses. In order to breed for more drought-tolerant cultivars, this study aims to identify drought tolerant mechanisms within existing cultivars of both southern highbush (SHB) and rabbiteye (RE) blueberries. We evaluated seven cultivars of southern highbush and rabbiteye blueberry for physiological response and fruit quality characteristics under water deficit and recovery across two consecutive years. Overall, drought was found to decrease photosynthesis, stomatal conductance, electron transport rate, leaf relative water content, specific leaf area, chlorophyll content, maximum rate of Rubisco carboxylation (Vcmax) and maximum rate of RuBP regeneration (Jmax). Additionally, drought treatment was found to significantly decrease yield and average berry weight while increasing total soluble solids and berry firmness. Misty (SHB) was identified as the most drought tolerant cultivar due to maintenance of CO_2 assimilation, stomatal conductance, and yield under drought conditions across both years, while Suziblue (SHB), Powderblue (RE), and Vernon (RE) were found to be more sensitive to water deficit. Star (SHB) was tolerant of drought in the short term but performed worse under repeated drought events.

Title: A novel solenoid-based approach for magnetic field integration in COLTRIMS experiments

Primary Author: Scott Chumley

Additional Authors: Trevor Olsson;Swapneal Jain;Gregory Young;Courtney Wicklund;Jody Davis;

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Abstract: Magnetic fields play a fundamental role in a wide array of physics experiments, offering precise control over charged particles and enabling the exploration of fundamental interactions in both classical and quantum systems. From early discoveries in electromagnetism to modern applications in spectroscopy, particle accelerators, and quantum computing, magnetic fields have been indispensable in advancing scientific knowledge. Their ability to influence particle trajectories, manipulate spin states, and confine plasmas has opened pathways to groundbreaking discoveries across multiple disciplines. In this study, we present a novel technique for introducing a magnetic field into a Cold Target Recoil Ion Momentum Spectroscopy (COLTRIMS) experiment using a finite solenoid. The magnetic field is generally achieved by using a set of large Helmholtz coils placed outside the vacuum chamber. Despite its simplicity, this approach suffers from a major drawback, any magnetic parts (turbomolecular pump, gauge, …) attached to the vacuum chamber distort the magnetic field lines in the spectrometer making it much harder to shield the spectrometer from extraneous fields. To circumvent this issue, we are developing a novel system where the Helmholtz coils are replaced by a solenoid directly placed around the spectrometer. In this study, we provide a comprehensive analysis of the total magnetic field generated by a finite solenoid and determine homogeneity of the system.

Title: Developing UV-LED photocrosslinking system for scalable 3-D tissue production

Primary Author: Sean Clark

Additional Authors: Elizabeth Lipke;Yuan Tian;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Tissue engineering of extracellular matrices (ECM) has become a cornerstone of biomedical research and regenerative medicine by offering a realistic and accessible environment for cell culture. Various ECM production methodologies have been developed, including microfluidic encapsulation, which offers precise control over size, cell distribution, and biocompatibility, but also low throughput. Our group has previously developed a microsphere production platform which used microfluidics to provide high accuracy and cell viability. However, previous systems were large and relied on dated and highly inefficient mercury arc lamps for photocrosslinking. To fix this, we have implemented custom UV-LED lighting, fluid delivery and control systems, and 3D printed microfluidic devices into a novel and scalable microsphere production platform.

Title: Automated Approach for Analyzing Differentiated Cardiomyocytes

Primary Author: Seohyeong Kim

Additional Authors: Elizabeth Lipke;Nathan Young;Shenbageshwaran Rajendiran;Mohammadjafar Hashemi;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cardiovascular diseases (CVD) remain the leading cause of death in the world, affecting nearly 18 million people each year. Following a CVD event, cardiomyocytes (CMs) are irreversibly damaged and are replaced by non-contractile scar tissues. In recent years, regenerative medicine has been a rising topic in addressing this global issue using stem cells, such as human induced pluripotent stem cells (hiPSCs). Current methods in monitoring the development and maturation of hiPSCs have been largely qualitative, which can be time-consuming and prone to subjectivity. To further support researchers in conducting more accurate and reproducible analyses of stem cells, this study aims to create a platform for quantitatively analyzing hiPSC-CMs through an automatic approach. Key functionalities from multiple algorithms were carefully extracted and combined to produce quantitative data on cellular and intracellular features. Consequently, userfriendly applications were designed to require minimal interaction with the underlying algorithm to ensure accessibility and ease of use. As a result, the interface enables the quantification of major cellular features, such as cell area, perimeter, elongation, and circularity, as well as intracellular features, such as mitochondrial count, mitochondrial area, and sarcomere length. This investigation is significant because it offers a more comprehensive approach to stem-cell research and analysis, which paves the way for greater advancements in clinical applications. Future work will explore a mixed-methods approach, leveraging the strengths of both quantitative and qualitative methods in stem-cell analysis.

Title: Exploring population dynamics of *Bacillus* and *Paenibacillus* co-culture and its effects on soybean disease control

Primary Author: Seoyeong Woo

Additional Authors: Mark Liles;Haley Stephens;

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College: College of Sciences and Mathematics

Abstract: The usage of agrichemicals has been one of the leading ways to control plant disease. However, prolonged usage of these chemicals can often cause significant environmental issues, and overuse can lead to eventual resistance resulting in crop losses. Therefore, there is a growing demand for new ways to control plant disease, especially biological solutions. Of the causal agents of plant disease, oomycetes have historically been one of the most devastating. Oomycetes possess morphological similarities to fungi, but genetic and cellular differences render many antifungals unusable against oomycetes. Many *Paenibacillus* possess biosynthetic gene clusters (BGCs), which encode secondary metabolites that inhibit the oomycete pathogen *Globisporangium ultimum*. Suspected co-cultures from the Auburn University Kloepper culture collection were analyzed to identify those with anti-*G. ultimum* activity. Anti-*G. ultimum* invitro plate assays were conducted, and zone of inhibition data was recorded. Of 80 cultures, 25 were found to inhibit *G. ultimum*. Co-cultures were then Gram-stained, and morphological characteristics of each co-isolate member were recorded. Cell pellets were then obtained and sent for genomic DNA extraction and sequencing. Future directions of this study include mining genome sequences for the presence of BGCs that contribute to plant pathogen control. Furthermore, co-culture members will be isolated, and single cultures will be compared against co-cultures in a follow-up Anti-*G. ultimum* assay. Following this, co-cultures will be used in an *in plantae* assay with soybean seeds to evaluate efficacy as a seed treatment. The final component of this study will include field tests to provide further insight into the behavior of these anti-oomycete co-cultures in a more complex soil environment. The exploration of probiotic bacterial co-cultures as a method of plant pathogen control may lead to an agriculturally sustainable alternative to traditional agrichemicals.

Title: Focused on Data and Education Analytics

Primary Author: Seungheon Kim

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College: Samuel Ginn College of Engineering

Abstract: Abstract (Symposium Submission) In today's education landscape, data-driven decision-making is essential to address academic disparities and improve student outcomes. This project presents a comprehensive plan to analyze and predict K-12 academic performance across Alabama by leveraging advanced AI techniques and machine learning methodologies. Our ultimate goal is to develop an interactive, web-based Academic Performance Dashboard that empowers educational administrators and policymakers with actionable insights derived from robust data analysis, predictive modeling, and real-time scenario simulations. The academic performance of K-12 students in Alabama is influenced by a variety of complex factors, including race, socioeconomic status, regional differences, and district-level resources. Identifying and analyzing these factors is crucial for improving student outcomes across diverse school districts. This project leverages data science and machine learning models (Lasso Regression) to build an interactive web-based Academic Performance Dashboard that enables school administrators to make data-driven decisions. By providing actionable insights and predictive capabilities, the dashboard helps administrators understand which factors significantly impact academic achievement and how adjustments in controllable variables can lead to improved outcomes. Project Scope and Objectives The primary objective of this project is to equip school leaders with the tools to analyze and predict student performance based on district-specific data. The dashboard provides the following core functionalities: 1. Data Filtering and Visualization: Users can filter and explore data based on categorical (e.g., grade, year, Locale4) and numerical variables (e.g., perasn, perblk, totenrl) to focus on specific aspects of district performance. This flexible filtering system allows for targeted analysis of key indicators. 2. Lasso Regression for Feature Selection: The Lasso Regression model identifies key predictors of academic performance by reducing less important variables and highlighting those that significantly affect outcomes. Parameters such as alpha and tolerance can be adjusted by users to control the regularization strength and optimization accuracy, allowing for more tailored results. 3. Achvz Prediction Tool: This feature allows users to set a target academic achievement score (Achvz) and predict how changes in selected factors—such as student demographics or funding allocation—can help reach that target. Handling Categorical Data with Encoding Techniques One of the critical challenges in this project was handling categorical data, such as district names (leanm), geographic classification (Locale4), and economic types (CT_EconType). Since machine learning models like Lasso Regression require numerical inputs, categorical variables must be converted into numerical form to be usable in the model. To address this, we implemented One-Hot Encoding and Label Encoding: * One-Hot Encoding was applied to variables with a limited set of categories, such as Locale4 (urban, rural, suburb, town), converting each category into a separate binary column (0 or 1). * Label Encoding was used for ordered variables or variables with many unique categories, such as district names, to assign unique integer values to each category. These encoding techniques significantly improved the accuracy and reliability of predictions, ensuring that categorical data contributes meaningfully to the final results. Lasso Regression and Model Tuning At the core of our predictive framework lies Lasso Regression, implemented using the scikit-learn library. Lasso is

chosen not only for its robust regression capabilities but also for its inherent feature selection property via L1 regularization. This approach penalizes less important features by shrinking their coefficients to zero, enabling us to isolate the most significant predictors of academic performance from a potentially vast set of variables. To enhance model performance and avoid overfitting, we employ rigorous hyperparameter tuning—adjusting parameters such as the regularization strength (alpha) and convergence tolerance. Techniques like cross-validation (using GridSearchCV) and optimization algorithms (such as coordinate descent) ensure that our model is both accurate and efficient. In summary, by combining meticulous data preprocessing, Lasso Regression with advanced hyperparameter optimization, and real-time scenario simulation within a user-friendly web interface, this project exemplifies how AI can be harnessed to address complex educational challenges. Our Academic Performance Dashboard is poised to serve as a pivotal tool in driving data-informed policy decisions, ultimately promoting equitable educational opportunities across Alabama's diverse school districts. The Lasso Regression model is at the core of this project's predictive capabilities. It is particularly effective for feature selection and regularization, automatically reducing the coefficients of less important variables to zero. Users can adjust key parameters to fine-tune the model: * Alpha (Regularization Strength): Controls how aggressively the model penalizes large coefficients. A higher alpha simplifies the model but may exclude relevant features, while a lower alpha retains more features but risks overfitting. * Tolerance (Stopping Criteria): Defines the precision of the optimization. Smaller tolerance values lead to more accurate results but require longer computation times. * Reduction Threshold: Allows users to set a threshold for coefficient magnitude, removing variables with small coefficients to simplify the model further. By adjusting these parameters, users can balance accuracy and interpretability, ensuring that the model provides actionable insights without overwhelming complexity. Achvz Prediction Tool The Achvz Prediction Tool enhances the dashboard's predictive power by allowing users to simulate how changes in specific factors can improve academic performance. For example, if an administrator wants to raise a district's target achievement score from 0.65 to 0.8, the tool provides recommendations on how to adjust controllable variables—such as increasing enrollment in advanced programs or reducing absenteeism rates—to meet that goal. Key features of the prediction tool include: * Target Setting: Users define a desired academic performance level. * Feature Adjustment: The model simulates multiple scenarios, showing how changes in each controllable factor affect the target. * Early Exit and Allowed Error: These settings prevent excessive computation while maintaining an acceptable level of accuracy in the prediction. The prediction tool only uses controllable variables for scenario generation, excluding variables like ethnicity from the prediction results while still considering them during training to improve accuracy. Practical Applications and Impact This project bridges the gap between data science and education policy by transforming complex machine learning models into practical tools that administrators can easily use. The insights provided by the dashboard can help districts allocate resources more effectively, target interventions to specific areas, and ultimately improve student outcomes. For example, administrators can identify underperforming schools in rural areas and compare their data with higher-performing schools to determine which factors might be driving the difference in performance. By focusing on district-specific data, this project avoids a one-size-fits-all approach. Instead, it empowers each district to address its unique challenges, providing targeted strategies for improvement. The dashboard's user-friendly design ensures that even users with minimal technical experience can interact with the model and interpret the results confidently. Built-in hint boxes explain critical parameters like alpha and tolerance, making it easier for non-technical users to fine-tune the model. Conclusion Ultimately, this project demonstrates how data science, machine learning, and user-centered design can drive educational improvement. The Academic Performance Dashboard serves as a valuable resource for educational leaders aiming to improve student outcomes through data-driven decision-making. With its powerful predictive capabilities and easy-to-use interface, the dashboard offers a new perspective on how school districts can understand and address the complex factors affecting academic performance. This work contributes to closing achievement gaps and enhancing education quality across Alabama's diverse school districts.

Title: AI-Driven optimization of faculty scheduling and campus resource allocation for enhanced academic efficiency

Primary Author: Seungtae Kim

Additional Authors: Seungheon Kim;Hyunwoo Lee;Chang Wook Ahn;

Department/Program: Industrial and Systems Engineering

College: Samuel Ginn College of Engineering

Abstract: Academic institutions continuously face challenges in balancing faculty workload scheduling and optimizing campus resource allocation. These issues directly affect teaching quality, faculty satisfaction, and student success. In response, this study proposes an innovative framework to streamline scheduling processes and enhance the management of campus resources. By analyzing historical data on faculty schedules, student enrollment trends, and classroom utilization, the framework forecasts future demand and identifies optimal workload distributions to meet academic needs. At the heart of this solution is a tailored scheduling algorithm that dynamically adapts to institutional constraints such as faculty availability, course requirements, and room capacity. Through simulation of various scheduling scenarios, the framework determines configurations that minimize conflicts, balance teaching loads, and improve resource utilization. Preliminary results indicate that the optimized schedules lead to a more consistent distribution of workloads, a reduction in overtime requirements, and overall improvements in operational efficiency. Furthermore, the evaluation of resource management strategies reveals that better alignment of resource use with actual demand can result in significant cost savings and a reduction in administrative burdens. Designed to be scalable and adaptable across different academic settings, the proposed framework offers a practical roadmap for institutions seeking to enhance operational efficiency and academic outcomes. By fostering a more supportive environment for both faculty and students, its implementation promises to contribute to sustained academic excellence. This research underscores the potential of data-driven approaches in transforming campus management, ultimately leading to improved scheduling fairness, increased operational efficiency, and a more responsive educational environment.

Title: Spray dried hollow carbon spheres from lignin: Adsorption equilibrium and thermodynamics study for highly efficient wastewater treatment

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Abstract: In recent years, the interest in hollow carbon spheres (HCSs) has increased for various applications because of their unique physicochemical properties and structure. In this work, HCSs were synthesized by spray drying lignin-KOH solution. Spray drying is an environment-friendly and scalable fabrication technique that has given rise to great HCSs size and shape uniformity. The particle size and surface morphology were characterized using a particle size analyzer and a scanning electron microscope for HCSs. The surface area of the HCSs carbonized at temperatures ranging from 700 to 900 °C was found to be 1100 m2 g-1 – 1500 m2 g-1. We utilized the lignin-derived HCSs as an adsorbent for wastewater treatment. Methylene blue (MB) was chosen as the model dye to investigate the effect of time, temperature, and MB concentration on adsorption. The carbonization temperature was the main control factor to tune the adsorbent microstructure. The kinetics study showed that the adsorption process occurs rapidly, with more than 95% dye removal (initial MB concentration < 150 mg L-1) by the HCSs in less than 5 minutes at room temperature. The adsorption isotherm analysis with the Redlich-Peterson model indicated that the maximum adsorption capacity was as high as 650 mg g-1 at room temperature. The adsorption thermodynamics studies revealed that the adsorption of MB is endothermic (ΔH = 30.4 kJ mol-1) with higher adsorption capacity at higher temperatures.

Title: Rare Event Uncertainty Quantification of Additively Manufactured Composites With High Throughput Tests

Primary Author: Shafi Shahriar

Additional Authors: Wen Luo;Logan Gotwalt;Robert Hudson;Ryan Weng;

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College: Samuel Ginn College of Engineering

Abstract: Additive manufacturing (AM) of composites has emerged as a revolutionary technology for composite manufacturing due to design flexibility, tailored material properties, and cost efficiency. However, printed composites exhibit much lower and scattered strengths than traditional composites and metals, highlighting the need to quantify their statistical strength distribution. This research presents a high-throughput testing method to efficiently characterize the material strength distribution, with a focus on the lower tail of the probability distribution—critical for evaluating reliability due to its representation of rare, low-strength failures that influence the safety and performance of engineering structures. The approach integrates multiple samples into a single testing specimen through series coupling, subjecting all samples to a uniform load. This induces sequential failure in ascending order of strength, significantly enhancing data acquisition efficiency for the lower tail reliability evaluation.

Title: Enhancing cytotoxic efficacy: novel PPAR-gamma agonists in the fight against aggressive breast cancers

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College: College of Sciences and Mathematics

Abstract: Breast cancer (BCa) remains a leading cause of mortality among women, with 2.3 million new cases resulting in over 670,000 global deaths annually. Despite advancements in early diagnosis and treatment, resistance and metastatic spread continue to pose significant challenges. The MDA-MB-231 cell line, a late-stage, triple-negative, highly invasive human breast cancer model, is often used to study these issues. A promising therapeutic target is the peroxisome proliferator-activated receptor (PPAR), a transcription factor with subtypes expressed in BCa cells. Activation of PPAR-γ has demonstrated tumor-suppressing effects and potential to inhibit BCa progression, while its action on cellular metabolic activity may support combination therapy with conventional chemotherapeutic agents. While PPAR agonists are clinically approved for diabetes, their toxicity has prompted the investigation of various derivatives that target other subtypes. Their antitumor activity and molecular mechanisms are largely unknown. This study evaluated the antitumor efficacy of the PPAR-γ agonist pioglitazone (PIO) and a novel partial agonist on MDA-MB-231 cells at varying concentrations. The potency (IC50) of each compound was determined, and protein expression was validated by immunoblotting to confirm the expression of known metabolic targets of PIO in BCa cells. Samples were also collected for transcriptomic analysis (RNA-seq). These data suggest that PIO and analogs show some antitumor activity but, more importantly, may modulate cellular metabolism and other pathways that enhance conventional anticancer agents. Future work will involve testing these combinations in drug-resistant MDA-MB-231 cells and utilizing three-dimensional spheroids to create more physiological models of BCa. Additionally, RNA-seq analysis will provide deeper insight into the gene expression responses of MDA-MD-231 cells to PPAR agonists, potentially identifying novel therapeutic targets.

Title: Public Knowledge of and Interactions with the Alligator Snapping Turtle (Macrochelys temminckii)

Primary Author: Shelby Davis

Additional Authors:

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Public education about the alligator snapping turtle (Macrochelys temminckii) is instrumental to the conservation of the species. Public knowledge of M. temminckii is often limited, and the similarities between M. temminckii and the common snapping turtle (Chelydra serpentina) may make identification difficult to the untrained eye. In order to assess current knowledge and recent interactions with M. temminckii, administered two survey instruments to Alabamians. Residents of Alabama who participate in aquatic recreation were surveyed on their previous knowledge of M. temminckii, as well as their interactions, if any, with the species. Participants were asked to provide details of their experience with M. temminckii, including the condition of the turtle, the location where it was found, and how the participant chose to interact with the individual. Additionally, a separate survey was administered to Alabama residents evaluating their ability to differentiate M. temminckii and the C. serpentina before and after viewing an identification information sheet. The sheet included a comparison of the two species and close-ups of distinct features that differ between species. This allowed us to both assess public identification skills at large while also allowing us to examine the efficacy of our educational product. Of the 45 encounters recorded with M. temminckii, 43 were reported alive and only 2 were deceased. Of the 11 respondents who handled the alligator snapping turtle they found, only two engaged in illegal activity: 2 chose to release the turtle in another location and none chose to dispatch the turtle. This suggests respondents either understood their protected status and/or did not view them as a significant enough threat to harm them. In the identification survey, we found that the average score before viewing the information sheet was significantly higher than the average score after viewing the information sheet (p=0.029). The data collected from these surveys will be used to further develop educational resources on M. temminckii and help to inform educational efforts in general.

Title: Safety of single-dose multi-site ultrasound neuromodulation for weight loss and improved metabolic function in domestic cats

Primary Author: Shelby McAlister

Additional Authors: Stephanie Maples;Robert Cole;Megan Grobman;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Obesity is common in domestic cats, contributing to insulin resistance and feline diabetes. Current therapies for diabetic cats involve daily treatments, which strain the owner-animal bond, creating a critical need for alternative therapies for obesity and insulin resistance in cats. Recent studies suggest multi-site peripheral-focused ultrasound stimulation at the liver and gastrointestinal tract, targeting the sympathetic nervous system, can prevent or reverse diabetes in several animal models of obesity. In this study, we aim to demonstrate the safety of neuromodulation in healthy domestic cats to improve insulin sensitivity. A GE LOGIQ E10 ultrasound system configured for targeted neuromodulation was used to treat five healthy adult cats. Health was assessed through a physical exam, CBC, biochemistry, urinalysis, and thyroid panel. A continuous glucose monitor (CGM) was placed to track interstitial glucose. The treatment involved a single dose of peripheral-focused ultrasound divided over two target sites: 30-minutes at the porta hepatis, followed by 30 minutes at the superior mesenteric plexus. Cats were monitored daily for two weeks post-treatment. After 30 days, biochemistry, urinalysis, and thyroid panels were repeated. All treated cats remained healthy, with no heat, redness, swelling, or pain at the stimulation sites. There was no change in appetite or behavior. No hypoglycemic events or adverse effects were reported. No hematologic or biochemical abnormalities were detected. Daily average interstitial glucose concentrations decreased by ~23mg/dL following treatment, which was consistent with serum glucose concentrations one month post treatment. Preliminary results suggest that single-dose, multi-site ultrasound neuromodulation is safe in healthy cats and may offer a novel therapy to improve blood glucose regulation. Future studies will explore metabolic efficacy in client-owned cats.

Title: Fused deposition modeling (FDM) process parameter optimization for Twill, Basket and Warp-Rib woven polymeric fibrous structures

Primary Author: Shree Ghimire

Additional Authors: Sabit Adanur;Ashok Sapkota;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Fused Deposition Modeling (FDM) is one of the popular additive manufacturing technologies. A filament is melted and deposited layer by layer to obtain the desired structure in this process. Due to its ability to process a variety of polymers, it is a suitable method to produce textile-like structures. Among these, woven structures are of particular interest due to their flexibility, durability, and unique load distribution characteristics. The motive of this study is to optimize the process parameters primarily the layer height and temperature such that the mechanical strength and the flexibility of the additively manufactured fibrous structures can be optimized, which are essential for fabric applications. PLA - a commonly used biodegradable polymer- is used to 3D print 3 different popular woven structures- 2/1 Twill, 2 by 2 Basket and 2 by 2 Warp-Rib. Tensile testing and flexural testing of the samples are carried out to evaluate their mechanical performance. The results are analyzed to determine the optimal combination of layer height and printing temperature, so that both strength and flexibility are enhanced. The study aims to provide insights into the relationship between FDM process parameters and the mechanical behavior of 3D-printed woven structures, contributing to the development of customized and high-performance textile-based applications in additive manufacturing.

Title: Variation in macro and micronutrient composition in broiler litter during storage

Primary Author: Shruthi Koneti

Additional Authors: Henry Torbert;Dexter Watts;Debolina Chakraborty;Rishi Prasad;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The United States poultry industry has witnessed a rapid expansion in the past few decades. A major challenge arising from this is litter management, as it generates 12.6 million metric tons of broiler litter (BL) annually. Broiler litter is a popular row crop soil amendment with a nutrient grade of 3-3-2 (N, P2O5, K2O). However, BL cleanout timing from poultry houses may not coincide with the optimal periods for field application, necessitating the storage of BL for varying durations. Storage conditions and duration can have a potential impact on nutrient transformations of BL. This study focused on quantifying the changes in nutrient concentration (pH, total carbon (TC) and total nitrogen (TN), mineral N, dissolved reactive phosphorus (DRP), total phosphorus (TP), total potassium (TK), total calcium (TCa), total magnesium (TMg), total copper (TCu) and total zinc (TZn)) from the BL during a 12-month period under three different storage conditions. Broiler litter heaps of 3.5 feet in height and 12 feet in width were created and replicated three times at the E.V. Smith research station in Shorter, Alabama. The treatments comprised a) uncovered stockpile (U), b) Tarp covered stockpile (T) and c) stockpile covered with a layer of soil (S). Nutrient concentrations were tracked monthly by using a multipoint sampling technique. We hypothesize that the type of storage method will alter the nutrient concentration of BL. Results suggest that after 12 months of storage, there was a 53% and 44% decrease in TC and a 66% and 59% decrease in TN for the U and S treatments, respectively. For TP, T treatment showed 23% losses, while U and S led to a greater decline by 45% and 41%, respectively. The BL under U and S treatment has shown the highest TK losses with 54% and 40%, respectively, indicating losses due to leaching and runoff. Covering BL with tarp can be adopted as the best management practice to reduce nutrient losses during storage and retain the fertilizing quality of BL.

Title: The application of freely available geospatial tools to monitor land management progress in Wildlife Management Areas

Primary Author: Sinka Khadijah Abubakar

Additional Authors: Jonathon Valente;Lana Narine;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Wildlife Management Areas (WMAs) are critical in supporting natural systems, biodiversity, and recreation opportunities. Effective management of these lands is essential to supporting biodiversity in the Southeastern U.S., where the area of protected lands is generally small. In 2008 – 2010, the Alabama Department of Conservation and Natural Resources (ADCNR) conducted a statewide wildlife inventory to set long-term conservation goals on their lands. To implement their management strategy, they used a grassroots approach where they allowed local biologists to make stand-level management decisions, expecting that these would meet statewide conservation goals. Fifteen years later (2024), we assessed the impact of these decentralized management efforts with a machine learning model, using predictors derived from Landsat imagery, ancillary datasets (e.g., digital elevation models), and field-based observations. We trained a Random Forest model to classify the landscape into 11 management-relevant landcover categories (pine and hardwood classes). Our maps achieved ~90% accuracy. Temporal trends indicate substantial progress toward conservation targets, with even-aged pine increasing from 23.11% in 2008 to 32.65% in 2024 and openings expanding from 3.04% to 6.91%, benefiting early successional wildlife species. Additionally, uneven-aged hardwood forests grew from 22.37% to 38.80% enhancing biodiversity and ecosystem resilience. Our study underscores the effectiveness of a bottom-up management approach, where local decisions align with broader conservation goals. By integrating satellite imagery with field data, our research provides a scalable and cost-effective framework for tracking land cover changes, offering valuable insights for wildlife managers and policymakers. Our findings demonstrate that remote sensing technologies can bridge critical monitoring gaps, enabling data-driven conservation planning to enhance biodiversity and habitat resilience in protected areas.

Title: The effect of lead knee extension velocity on ball velocity in youth baseball catchers

Primary Author: Sofia Byrd

Additional Authors: Gretchen Oliver;Kai-Jen Cheng;Ian Jump;Ryan Zappa;

Department/Program: School of Kinesiology

College: College of Education

Abstract: In baseball, catchers play a pivotal role in preventing stolen bases. To do this, the catcher must receive a pitch, quickly transfer to the ideal throwing position, and make a quick and accurate throw to the designated base. While pitchers who have a higher lead knee extension velocity often display higher fastball velocity, it is not known if catchers have similar characteristics. The purpose of this study was to investigate the effect of lead knee extension velocity on ball velocity in baseball catchers. Motion capture data were collected for 29 catchers (1.67±0.13m, 61.0±16.3kg, 14±2y) using an electromagnetic tracking system (100 Hz). Participants conducted three pop-up throws, throwing to a target placed at 27.4m toward second base. A radar gun was used to collect ball velocity for each throw. A bivariate linear regression ($\alpha=.05$) was used to assess the effect that peak lead knee extension velocity has on ball velocity. Prior to analysis, the data was screened and one outlier, with a z-score greater than 3, was removed. The linear regression showed no significant findings ($F(1,51)=1.56$, $p=0.217$, $R2=0.03$). While these results are not significant, the data displayed a minuscule inverse trend between peak knee extension velocity and ball velocity. These findings contradict what has been found in previous research into overhead throwing velocity, which mostly focuses on baseball, and highlights the unique lower extremity mechanics of the catcher. This difference in findings is hypothesized to be attributed to the constraints of each position, with pitchers throwing down the mound and catchers throwing after transitioning from a squatted position with an added constraint of time. This study provides some insight into the idea that pitching mechanics may not be generalizable, as well as the need to investigate the throwing mechanics of catchers to find which are linked to performance and which are linked to the reduction of injury risk.

Title: The Supplemental Nutritional Assistance Program payment cycle and mental stress in Alabama

Primary Author: Sonia Afrin

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Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: The Supplemental Nutrition Assistance Program (SNAP) is a benefit program for low-income citizens struggling with food insecurity. Payments are made to recipients once a month, on different days of the month, depending on when they sign up. Recipients frequently run out of benefits by the end of the month, which is often linked to end-of-month food insecurity. Food insecurity can contribute to poor mental health. This study examines the relationship between the SNAP payment cycle and the recipient's mental stress. We leveraged an online survey of SNAP participants in Alabama that measures both the number of days since a participant's household received SNAP benefits and the participant's self-reported mental stress. To measure mental stress, this paper uses a 10-item Depression Anxiety Stress (DASS-10) scale. The DASS-10 measures overall distress, combining symptoms of depression and anxiety. We used Ordinary Least Squares (OLS) to assess the effect of the SNAP cycle on mental stress. The result finds that the total distress significantly increases with the number of days after the first half of a SNAP cycle. We further apply the same method to two components – anxiety and depression separately for disaggregated analysis. The SNAP recipients' anxiety is also found to increase with the number of days after the first half of a SNAP cycle. The same is true for depression though the association is not statistically significant. These results underscore the psychological strain as the food benefit depletes in a SNAP cycle. We further investigate the effect of SNAP nutrition incentives and the potential mediatory role they could play on the relationship between mental stress and the depletion of SNAP benefits in each cycle. We find that the effectiveness of this incentive program as a mediator is limited. This study shows that there is room for policy interventions to improve the incentive program so that it would mediate mental stress and SNAP benefit depletion better.

Title: Languaging experiences of international Chinese students at an English-speaking university

Primary Author: Sophie Young

Additional Authors:

Department/Program: Sociology

College: College of Liberal Arts

Abstract: International students make up 5.6% of students enrolled in universities in the U.S., contributing roughly $40 billion to the U.S. economy per year. Institutions are incentivized, monetarily and in terms of campus diversity and globalization, to bring in these students. However, the academic and social difficulties of learning and living in a non-L1 (not an individual's primary or "native" language) are often underemphasized and under supported, leaving students to adapt to not only a new language of instruction but also a new culture of learning. Utilizing the traditional anthropological research method of in-depth, one-on-one ethnographic interviewing and processes of qualitative analysis, this study aims to showcase 1.) the motivations for international students to study in the U.S., 2.) the surprises and misconceptions of students about studying in the U.S., 3.) the misconceptions of the university system about students' linguistic abilities, 4.) the social and academic challenges international students experience studying in their L2+, and 5.) the coping strategies students implement in order to succeed in the U.S. collegiate education system. Additionally, the study proposes changes for consideration by American collegiate institutions in an effort to make the transition to American English universities more successful for international students. These proposals come directly from ethnographic study interviews of students who attend American English-centered universities and have found opportunities for improvement in the existing support systems.

Title: Exploring Generative AI Literacy and RESPACT in Hospitality, Tourism, and Events Curricula: A Malaysia-U.S. Comparison

Primary Author: Souji Gopalakrishna Pillai

Additional Authors: Alecia Douglas;

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: The study compares AI literacy and ethical integration of generative AI (GenAI) in hospitality, tourism, and events curricula across Malaysia and the United States. Focusing on academic faculties, heads of schools, and both undergraduate and graduate students, it investigates their awareness of the RESPACT framework (Responsiveness, Ethics, Security, Privacy, Accountability, Consent, and Transparency) and how they apply it in relation to GenAI tools. The study also examines the role of the RESPACT declaration integrated into syllabi and assignments, including faculty-mandated student declarations during assignment submissions, to assess students' understanding of responsible AI use in academic tasks. The rising adoption of GenAI in hospitality, tourism, and events education presents opportunities for innovation but raises concerns regarding responsible use, data privacy, and academic integrity. While GenAI adoption is widely studied in other fields, limited research focuses on its ethical application in hospitality and tourism education. This study addresses this gap by examining the intersection of GenAI literacy across terms, tools, and tasks and its ethical use as guided by the RESPACT framework. The objectives are to assess awareness of RESPACT among educators and students, explore the extent of their GenAI literacy, evaluate how they integrate GenAI responsibly in academic work, and identify challenges in applying RESPACT in academic settings. Semi-structured interviews will be conducted, and thematic analysis applied to uncover cross-country differences in navigating GenAI's ethical dimensions. The findings will inform curriculum development, address knowledge gaps, and offer actionable recommendations for fostering responsible AI integration in hospitality, tourism, and events education globally.

Title: Pelletizing Poultry Litter with Biochar: Impacts on Environmental Sustainability and Nutrient Management

Primary Author: Soura Gupta

Additional Authors: Debolina Chakraborty;Rishi Prasad;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Alabama, a leading broiler producer, generates approximately 1.5 million tons of litter that pose significant environmental challenges, including odor, greenhouse gas emissions, and water contamination. The present study explored a sustainable approach by mixing poultry litter (PL) with biochar (BC) at six ratios i.e., Bio0 (100 % PL), Bio25 (75 % PL + 25 % BC), Bio50 (50 % PL + 50 % BC), Bio200 (33 % PL + 67 % BC), Bio 75 (25 % PL + 75 % BC), and Bio 400 (20 % PL + 80 % BC) following pelletization. The physical (particle size, density, hardness, and durability) and chemical (water-soluble ammonia, nitrate, phosphate, and total carbon and nitrogen content) properties were analyzed for non-pelletized and pelletized samples to assess the effect of biochar addition and pelletization. Pelletization increased dry matter, whereas additions of biochar at lower rates (Bio25, Bio50) enhanced dry matter, while higher rates of biochar (>50%) additions reduced the drymatter. The particle size increased with biochar addition. Pelletization increased the density of litter, whereas addition of biochar decreased the density in the non-pelletized samples, while increasing it in the pelletized samples. Pellet hardness decreased with higher biochar rate (>50 %), but durability remained satisfactory (>88%), with Bio0 (96.9 %) and Bio200 (96 %) showing the highest durability. Biochar addition significantly reduced the PO4-P, NH4-N, and NO3-N release, while pelletization further decreased PO4-P release but did not contribute to NH4-N or NO3-N release. Pellet production rates increased with biochar addition, reaching 68.6 kg hr-1 (Bio0) to 144 kg hr-1 (Bio400), while lowering the energy consumption from 10.9 kW.hr kg-1 (Bio0) to 1.60 kW.hr kg-1 (Bio400). This study demonstrates that pelletizing poultry litter with biochar stabilizes nutrient release, enhances energy efficiency, and offers a sustainable waste management solution with potential economic benefits.

Title: A toxic love story: Investigating PFAS interactions with microplastics in sediment

Primary Author: Steven Mai

Additional Authors: Gabe Robinson;Soleil Sklencar;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Per- and polyfluoroalkyl substances (PFAS) are synthetic chemicals characterized by their persistent carbon-fluorine bonds, which make them highly resistant to degradation. PFAS are widely used in the production of goods due to their water-, oil-, and grease-resistant properties. Over time, PFAS can leach from these products, accumulating in soil and water. Studies have shown that PFAS exposure, through ingestion or contact, can have adverse effects on human health. PFAS interacts with soil particles via adsorption, binding to sediment surfaces. Microplastics, another pervasive pollutant, are similarly prevalent in manufacturing due to their lightweight, durable, and moisture-resistant properties. Over time, plastics degrade into microplastics (MPs) —particles smaller than 0.5 mm—which often end up in water bodies and soil. MPs have also been linked to harmful effects on human health through contaminated water, food, and plastic use. Although both PFAS and MPs are recognized as toxic pollutants, little is known about the consequences of their interactions in sediment. This research investigates the adsorption interactions between PFAS, MPs, and sediment. To explore this, 150 µm diameter MP beads were aged in an aquatic mesocosm for one year to observe chemical and physical modifications. Three sediment conditions were tested: pristine MPs in sediment, aged MPs in sediment, and sediment without MPs. Six of the most common PFAS were evaluated at concentrations ranging from 0.5 µg/L to 50 µg/L. Initial results indicate that aged MPs absorb more PFAS than pristine MPs due to an increase in oxygenated functional groups formed during aging. Understanding these surficial transformations is critical for advancing MP research and can inform future studies on MP remediation and adsorption mechanisms.

Title: Nationwide seroprevalence of SARS-CoV-2 Delta variant and five Omicron sublineages in companion cats and dogs in the USA: insights into their sentinel role in tracking COVID-19 epidemiology

Primary Author: Suchita Barua

Additional Authors: Subarna Barua;Chengming Wang;Kelley Turner;Theresa Wood;Laura Huber;Peter Christopherson;Kelly Chenoweth;Calvin Johnson;Yue Shu;Hill Dimino;Asfiha Tarannum;Nneka Iduu;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Understanding SARS-CoV-2 epidemiology in companion animals is critical for evaluating their role in viral transmission and their potential as sentinels for human infections. Epidemiological data on SARS-CoV-2 infections in companion animals have been extensively studied, but information on antibodies against SARS-CoV-2 variants in these animals is still limited. To address these knowledge gaps, we aimed to determine the prevalence of antibodies against SARS-CoV-2 variants and identify potential risk factors. This large-scale serosurvey analyzed serum samples from 706 cats and 2,396 dogs collected across the USA in 2023 using a standard and variant-specific surrogate virus neutralization test (sVNT) to detect antibodies for SARS-CoV-2 variants. All data were analyzed using the STATISTICA 7.1 software. Chi-square tests were employed to analyze the significance of the relationships among the risk factors. Overall, 5.7% of cats and 4.7% of dogs tested positive for antibodies, with younger animals (under 12 months) exhibiting significantly lower seropositivity rates ($p=0.0048$). No significant differences were found based on sex or breed. Furthermore, we analyzed 153 positive samples for variant-specific antibody responses using six sVNT kits that target Delta variant and five Omicron sublineages. Among cats, 67.5% showed antibodies to Delta, with positivity rates for Omicron sublineages as follows: BA.1 (62.5%), BA.2 (42.5%), BA.4/BA.5 (77.5%), XBB (52.5%), and XBB.1.5 (45.0%). In dogs, 55.8% were positive for Delta, and Omicron sublineage rates were BA.1 (46.0%), BA.4/BA.5 (37.2%), XBB (58.4%), BA.2 (13.3%), and XBB.1.5 (9.7%). Considering the close interactions between companion animals and humans, along with the persistence of antibodies against various SARS-CoV-2 variants and sublineages, our findings suggest that cats and dogs could be valuable sentinels for monitoring COVID-19 epidemiology.

Title: Advancing Soil Moisture Monitoring: AI-Driven Multi-Scale Estimation with DEMS

Primary Author: Sudhanshu Kumar

Additional Authors: Di Tian;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Accurate soil moisture (SM) monitoring is essential for agriculture, hydrology, and drought prediction. Advances in satellite observations, land data assimilation systems (LDAS), and artificial intelligence (AI) have enabled scope for high-resolution, multi-scale SM estimation. Integrating satellite and LDAS data enhances monitoring capabilities, particularly in regions lacking in-situ observations, benefiting both scientific research and practical applications. In this research, we developed a deep learning model, named Deep Emulator for Multi-scale Soil moisture monitoring (DEMS), to monitor root-zone SM from field to regional scales. The DEMS integrates LDAS forcings and simulations from randomly sampled locations into a bidirectional long short-term memory (B-LSTM) deep learning framework. DEMS is further enhanced by incorporating 30-m satellite-based evapotranspiration, land cover, topographic data, and digital soil property data. The DEMS demonstrates robust performance, achieving a mean squared error (MSE) below 0.0004, a Pearson correlation coefficient greater than 0.8, and a Kling-Gupta Efficiency (KGE) score above 0.75 when compared against LDAS SM. The DEMS can generate daily SM data at a 30-m resolution and effectively capture field-scale variability and drought conditions. DEMS outperforms NLDAS and SMAP L4 SM during drought events, aligning well with in situ observations. Among all input variables to the emulator, evapotranspiration is the most important variable for accurate SM estimations, followed by air temperature. The strength of this method lies in its ability to combine process-based physical knowledge from land surface models with satellite observations, enabling scalable SM estimation. This method can be easily applied to new locations without requiring ground-based observations, making it a versatile tool for large-scale SM monitoring.

Title: Investigating tetrahydrocurcumin potential for neuroprotection and its function as a therapeutic and preventive metabolite in neurodegenerative diseases

Primary Author: Suhrud Pathak

Additional Authors: Satyanarayana Pondugula;Preston Cook;Keyi Liu;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: One of the most advantageous natural compounds utilized worldwide is curcumin, often known as curcuma longa or turmeric, because of its strong pharmacodynamic qualities with minimal side effects. Curcumin has been utilized both prophylactically and therapeutically as a nutraceutical and dietary supplement. Additionally, it has also been used for cosmetic purposes. The low bioavailability of Curcumin, on the other hand, has long minimized its use in healthcare. As a result, research on curcumin's metabolites has recently gained prominence, and several studies have been conducted to improve curcumin utilization. Curcumin or curcuminoid metabolites also exhibit biological activity that is equivalent to or superior to that of its precursor, according to past and current studies. The current study aimed to establish novel neuroprotective activities of Tetrahydrocurcumin (a key curcumin metabolite). To elucidate and validate the neuroprotective properties of Tetrahydrocurcumin along with potential neuroprotective mechanisms, both in-silico and in-vitro studies were carried out. The effect of tetrahydrocurcumin on the viability of hippocampus and dopaminergic neurons was demonstrated using HT-22 (hippocampal neurons) and N27 (dopaminergic neurons). Additionally, to study the neuroprotective mechanisms, markers of oxidative stress, mitochondrial function, inflammation, and apoptosis were examined. Tetrahydrocurcumin demonstrated significant neuroprotection on both hippocampal and dopaminergic neurons. The neuroprotection was attributed to its antioxidant and anti-apoptotic actions. Furthermore, RNA sequencing was performed to validate the neuroprotective effects. Thus, Tetrahydrocurcumin can be an impactful therapeutic natural bioactive metabolite for preventing, reducing the rate of progression, and treating neurodegenerative pathologies.

Title: Exploring oncolytic viral therapy to target osteosarcoma

Primary Author: Sumbul Khan

Additional Authors: Payal Agarwal;Gracie Bunch;Isabella Shimko-Lofano;Terri Higgins;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Osteosarcoma (OS) is a mesenchymal neoplasm that makes up 3% of all malignancies in children. The mortality rate has not changed in the last few decades. Therefore, the development of advanced cancer therapies is essential. We hypothesize that next-generation conditionally replicative oncolytic virus with an armed anti-PD1 antibody will lyse the OS cells and initiate the immune response against tumor cells in the tumor microenvironment. The study aims to evaluate the oncolytic activity and production/ secretion of anti-PD1 Ab of conditionally replicative Canine adenovirus type 2 armed with anti-PD1 Ab (CAV2-AU-M3). To achieve this aim, we infected four canine OS cell lines with CAV2-AU-M3 and measured its cytotoxicity by performing a cell viability assay using luciferase expression. We have performed western blot to evaluate the secretion and expression of anti-PD1 Ab in the TME. Flow cytometry was performed to confirm the functionality of anti-PD1 Ab, i.e, binding of anti-PD1 Ab to PD1 receptors expressed on the cell surface and its ability to inhibit PD1 and PDL1 interaction. We measured DAMPs (damage-associated molecular patterns), such as calreticulin, HMGB, and ATPs, to assess whether the virus can stimulate an immune response. Calreticulin expressions were analyzed by western blot post 72hrs of CAV2-AU-M3 infections. We have found that CAV2-AU-M3 is lytic in OS cell lines (D17, CF-11, and MCKOS) in both 2D (Monolayers) and 3D (Tumor spheroids) cell cultures, and it also produced and secreted anti-PD1 Ab, which binds to PD1 receptor efficiently and inhibited the interaction between PD1 and PDL1. We concluded that CAV2 AU M3 is a potent armed oncolytic virus that can lyse and kill OS cells and produce functional anti-PD1 Ab. The expression of calreticulin was found to be elevated in virus-infected cell lines compared to uninfected ones.

Title: Global trends in food affordability: A multilevel analysis from 2009 to 2023

Primary Author: Susan Osayande

Additional Authors: Thomas Fuller-Rowell;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Food insecurity is a significant public health concern, particularly for low-income populations worldwide. While extensive research has examined the socioeconomic underpinnings of food insecurity, there is a paucity of studies comparing trends within low-income populations and across different age groups. Identifying trends over time and by specific age groups is crucial for informing targeted policies, understanding age-specific vulnerabilities, and health disparities, and making future predictions. This study examines trends in food insecurity among individuals in the bottom 60% income bracket across multiple countries from 2009 to 2023. Utilizing country-level data from the Gallup World Poll, we employ multilevel modeling to analyze temporal trends. Countries are categorized based on the Human Development Index (HDI), which assesses average achievements in three fundamental aspects of human development. Based on the HDI, we classify countries into three categories: low, medium, and high human development. We further analyze these trends across two age groups: individuals below and above age 50. This study focuses on identifying global trends within the specified income and age groups. By examining these patterns, we aim to provide insights into how food affordability has changed over the years and to inform policy interventions targeting specific countries that drive the trends in each HDI category.

Title: Investigating the influence of runway walking training on gait adaptation using asymmetric visual feedback: A pilot study

Primary Author: Susannah Harrell

Additional Authors: Kenneth Harrison;Keven Gerardo Santamaria-Guzman;Brandon Peoples;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Gait adaptation represents our ability to adjust walking patterns to navigate environmental demands safely. Traditional research has used split-belt treadmill (SBT) walking to study how different brain regions respond to novel walking patterns, revealing age-related differences in adaptation strategies. Similarly, runway models develop a deliberate mastery over their walking patterns, implementing adaptations for aesthetic precision, spatial awareness, and temporal control. Current research suggests that with aging, people shift from using space (where they step) to timing adjustments (when they step) when learning novel walking patterns, revealing age-related differences in adaptation strategies. The controlled movement in runway walking training (RWT) could enhance older adults' gait adaptability, offering structured spatial and temporal control practice that may help them better navigate challenging environments despite age-related changes. Therefore, this study examines the impact of external asymmetric visual feedback on gait adaptation in young adults with RWT compared to young adults without training. Seventeen participants (8RWT) between 18 - 27 were recruited for this study. Participants in the RWT group had ≥ 1 year of RWT. Using marker-based motion capture, participants received external visual feedback during SBT walking with the belts coupled (both belts moving at the same speed) and decoupled (both belts moving at different speeds). A two-way repeated measures ANOVA was conducted to determine the difference in gait adaptation between groups across different epochs. Our repeated measures ANOVA revealed that participants within each group adapted their gait differently in response to a novel walking pattern ($p<.001$); however, there were no group differences ($p >.05$). In our sample, both groups adapted their gait in response to a novel walking pattern. This suggests that external visual feedback affects gait adaptation similarly regardless of prior RWT.

Title: Remote Sensing-Based Detection of Brown Spot Needle Blight: A Comprehensive Review, and Future Directions

Primary Author: Swati Singh

Additional Authors: Lori Eckhardt;Janna Willoughby;Lana Narine;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Pine forests are increasingly threatened by needle diseases, including Brown Spot Needle Blight (BSNB), caused by the fungal pathogen Lecanosticta acicola. BSNB leads to needle loss, reduced growth, significant tree mortality, and disruption in global timber production. Due to its severity, L. acicola has been designated as a quarantine pathogen in several countries, necessitating effective methods for early detection and control of its spread. Remote sensing (RS) technologies enable broad-scale surveillance for disease detection while potentially offering scalable and effective solutions. However, the extent to which RS can be applied to assessing BSNB is unknown. The goal of this study is to present a systematic review of RS-based detection methods for BSNB symptoms, assessing current research trends and potential applications. A comprehensive bibliometric analysis was conducted using the Web of Science database. Results highlight that while direct RS applications for BSNB are limited, research on other needle diseases demonstrates the effectiveness of multisource RS techniques in detecting disease symptoms, mapping spatial distributions, and conducting severity assessments. Additionally, advancements in machine learning (ML) and deep learning (DL) have significantly expanded the potential of RS technologies for automated disease classification and predictive modeling in forest health monitoring. Climate-driven factors, such as temperature and precipitation, play a key role in shaping the distribution and severity of emerging pathogens and integrating climactic conditions with RS-based monitoring may enhance early detection and risk assessment. However, despite promising advancements, research on the direct application of RS for BSNB symptom detection is very limited. Overall, this review identifies critical knowledge gaps, and potential avenues for further research for improved BSNB management.

Title: Ioncell® fibers incorporated with functionalized cellulose nanofibrils: effect on spinnability and properties

Primary Author: Sydney Brake

Additional Authors: Adriana Restrepo Osorio;Soledad Peresin;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Chemical modifications to the surface of regenerated cellulose fibers are employed to improve cellulose properties and functionality such as hydrophobicity, conductivity, or adhesion for engineered textile applications. Alternatively, due to the nature of the processing method, Ioncell® fibers can be incorporated with additives to provide a new desired property. Previous work has utilized cellulose nanocrystals (CNCs) in regenerated cellulose textiles to improve properties such as tensile strength, but this work seeks to incorporate modified cellulose nanofibrils (mCNFs) into a textile as proof of concept that the functionality can be introduced by this method. In this work, CNFs are modified with a silane coupling agent, available to undergo a “click” reaction with additives possessing a terminal alkene.The objective is to introduce the thiol functionality to the textile via dissolution of modified CNFs. To achieve this bleached softwood pulp was fibrillated, and the resultant CNFs were modified with a thiol functional group via an environmentally friendly silane hydrolysis and condensation silanization (mCNF) reaction. This modified CNF was dissolved in ionic liquid along with dissolving pulp to attain a controlled concentration of the functional groups. Cellulose-mCNF fibers were spun using Ioncell® technology, resulting in fiber that contains a percentage of regenerated CNF. During this process, majority of the silane coupling agent did not survive the dissolution and was broken by the ionic liquid before being removed by the coagulation bath. However, the resulting unique CNF-incorporated fibers were tested for chemical properties with Fourier transform infrared spectroscopy (FTIR) and nuclear magnetic resonance (NMR), mechanical properties, and morphological properties using scanning electron microscope (SEM), X ray diffraction (XRD), and polarized light microscope.

Title: Metabolic and anticancer activities of novel PPAR ligands in prostate cancer therapy

Primary Author: Sydney Hamilton

Additional Authors: Lani Jasper;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Despite existing treatment strategies, prostate cancers (PCa) eventually develop drug resistance, metastasize, and are the 2nd leading cause of cancer mortality in men in the U.S. Differences in inflammatory responses and metabolic changes are thought to drive disease progression and disparities among patient populations. The anticancer activity of existing peroxisome proliferator-activated receptor (PPAR) agonists, transcription factors with multiple subtypes, has been evaluated in PCa. Activation of PPAR-γ has demonstrated tumor-suppressing effects and the potential to inhibit PCa progression. However, its cellular metabolic activity in cancer is largely unknown. While PPAR agonists are clinically approved for diabetes, their toxicity has prompted the development and investigation of various derivatives with unique activity. In this study, we evaluated the antitumor efficacy of the PPAR-γ agonist pioglitazone (PIO) and novel partial agonists on PC-3, castration-resistant, androgen receptor-negative, metastatic, neuroendocrine, variant model of human PCa. The potency (IC50) of each compound was determined, and protein expression was validated by immunoblotting to confirm the expression of known metabolic targets of PIO in PCa cells. Samples for future transcriptomic analysis (RNA-seq) were also collected. These data suggest that PIO and its analogs exhibit antitumor activity in PC-3. More importantly, they have the potential to modulate cellular metabolism and other pathways, thereby enhancing the efficacy of conventional anticancer agents and offering a promising avenue for improved cancer treatment strategies. Future work will involve testing these combinations in drug-resistant PC-3 cells and utilizing three-dimensional spheroids that are more physiological models of PCa. Additionally, RNA-seq analysis will be used to gain greater molecular insight into differences in PPAR agonists activity.

Title: Linkages between brand logos and brand equity: A systematic literature review

Primary Author: Tahseen Tawseef

Additional Authors: Mohammed Siddique;Wis Kwon;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This paper provides a systematic review of existing literature on linkages between brand logo attributes and brand equity. Brand logos are designed with various visual characteristics, such as logo shape, color, and text attributes. These logo attributes may influence brand equity, or differential effects of a brand as compared to a generic brand, at the customer, market, and financial market levels. However, no comprehensive understanding about the logo effects on brand equity has been achieved despite their importance. This study addressed this gap by conducting a systematic review of a sample of 27 empirical research articles which examined brand logo-equity relationships during the last decade (2014-2023), identified through a search using ProQuest. The analysis of the 27 articles employing the grounded theory approach (inter-coder reliability = .96 - .99) revealed seven logo shape attributes (e.g., logo type, circularity/angularity, and symmetry), one color attribute (i.e., colorfulness), one text attribute, and three other attributes (i.e., animation, personality, and contextual relevance) which were connected to brand equity variables at the customer level (top 2 examples: brand attitude, brand personification) and one financial-level equity variable. The findings revealed that logo colorfulness and logo type were the most frequently studied logo attributes in relation to brand equity. This study also revealed several significant literature gaps; for example, no studies examined logo effects on the market-level brand equity (e.g., sales, market share), while equity in terms of a long-term customer-brand relationship had not been examined in relation to brand logo shape, color, or text attributes. This study is the first comprehensive systematic review of literature on relationships between brand logo attributes and brand equity. Findings of this study shed light on the existing research gaps and directions for future research on these relationships.

Title: Sorbitol as an Eco-Friendly Additive to Prevent Cracking in Sheared Cellulose Nanocrystal films

Primary Author: Tanmay Rahman

Additional Authors: Virginia Davis;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cellulose nanocrystals (CNCs) offer exceptional mechanical properties, tunable surface chemistry, and processability, making them ideal for advanced material applications. However, their rigidity causes aligned CNC films to develop cracks and curls inhibiting their applicability. Previous studies have incorporated polymers to address this issue. However, these additives often weaken the mechanical properties of CNC films. In contrast, eco-friendly small molecular additives like glycerol and sorbitol have demonstrated potential in reducing cracks and curls in drop-cast CNC films without significant adverse impact on film strength but their impact on shear cast films has not been explored. This study investigated the impact of sorbitol concentration on CNC dispersion microstructure, rheological properties, and the properties of sheared films. Sorbitol was incorporated into aqueous sulfated CNC dispersions, and its effects were analyzed using a cross-polarized microscopy to examine microstructural changes, while a rheometer was used to assess the flow behavior. The results showed sorbitol did not prevent cholesteric liquid crystal phase formation, but it lowered the low shear viscosity of the dispersion which was attributed to the plasticization effect of sorbitol. After shear casting and drying, the mechanical, thermal properties, and nanocrystal orientation of the dried films were measured. Thermal analysis indicated that increasing sorbitol content enhanced the thermal stability of the films. Optical contrast measurements revealed that sorbitol had little influence on the alignment of nanocrystals in shear-cast films. Mechanical testing showed shear during processing did not significantly affect tensile strength or Young's modulus, though elongation at break improved with sorbitol addition. These results highlighted sorbitol's role in shaping the microstructural alignment, thermal and mechanical behavior, and overall processability of bioderived CNC films.

Title: Downscaling MODIS land surface temperature using multi-source remote sensing observations and super-resolution deep learning

Primary Author: Taufiq Rashid

Additional Authors: Di Tian;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Land surface temperature (LST) is an essential variable for many applications, such as evapotranspiration and drought monitoring, climate modeling, and studying urban heat islands. To obtain LST data over large areas, a cost-effective and efficient spaceborne remote sensing method is utilized. Moderate Resolution Imaging Spectroradiometer (MODIS) is a widely used LST product due to its daily coverage and longer time span (> 20 years), but its relatively coarse 1-km spatial resolution limits its applicability. Since 2018, ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) mission unprecedentedly provides LST data at a 70-m spatial resolution. However, this is limited by the revisiting time (1–5 days), cloud impacts, and mission continuity. In this study, we developed a framework for generating 100-m LST using attentive super-resolution deep residual network (ASRRN) with MODIS and ECOSTRESS LST data as well as the Harmonized Landsat Sentinel-2 (HLS) surface reflectance (Red, NIR, NDVI, SWIR1), Sentinel-1 Synthetic Aperture Radar (SAR), and ASTER Digital Elevation Model (DEM) data. Our results indicate that the ASRRN model, incorporating MODIS LST, HLS SWIR1 and NDVI, and DEM shows the best performance when cross-evaluated against ECOSTRESS LST in 12 regions over the contiguous US (CONUS) between 2018 and 2022. It generates a much denser 100-m estimated LST series while maintaining similar accuracy compared to the original ECOSTRESS LST as evaluated against in situ LST observations from the United States Climate Reference Network (USCRN). ASRRN also substantially outperforms the ESTARFM data fusion technique when evaluated against either ECOSTRESS or USCRN LST. The strengths of ASRRN are due to its ability to generate more accurate, denser LST series at high resolution (100-m) compared to the current data fusion approach, even when ECOSTRESS LST is not available, and can be useful to address several important challenges of high-resolution LST monitoring.

Title: Gain-of-function mutant alleles of the ERBB4 gene may drive a gender disparity in BRAF-WT melanomas

Primary Author: Teigen Nelson

Additional Authors: David Riese;Lauren Lucas;Reed Hilton;Haram Kim;Markelle Scott;Ella Wilson;Vipasha Dwivedi;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Melanoma is the fifth most common type of cancer in the U.S. and the most aggressive form of skin cancer. Approximately 50% of melanoma cases possess a gain-of-function (GOF) BRAF mutant allele (BRAF-Mut), and 50% have wild-type (WT) BRAF. Metastatic BRAF-Mut tumors respond well to immune checkpoint inhibitors (ICIs) or a combination of BRAF and MEK inhibitors. However, metastatic BRAF-WT tumors are less responsive to these same treatments. Hence, we aim to identify potential targets and new therapeutics to treat these tumors.ERBB4 is a member of the ERBB family of receptor tyrosine kinase, which includes EGFR, ERBB2, and ERBB3. In silico analysis of the genomes of BRAF-WT melanomas revealed candidate GOF ERBB4 mutant alleles. Analysis of this dataset also indicates that ERBB4 mutant alleles are more common in deceased male BRAF-WT melanoma patients than deceased female BRAF-WT melanoma patients. Thus, we hypothesize that ERBB4 GOF mutant alleles disproportionately drive BRAF-WT melanomas in males. We have identified nine candidate ERBB4 GOF mutant alleles from BRAF-WT melanoma samples (G85S, R106C, S418F, E452K, R711C, G741E, P759L, D861N, and R992C). However, we were surprised that only the G85S and G741E ERBB4 mutant alleles exhibit greater oncogenic activity than WT ERBB4 in the MEL-JUSO female BRAF-WT melanoma cell line. We are testing whether the ERBB4 mutant alleles exhibit greater oncogenic activity in the MeWo male BRAF-WT melanoma cell line than in the MEL-JUSO cell line. Such results would support our hypothesis that ERBB4 GOF mutant alleles disproportionately drive BRAF-WT melanomas in males and would motivate additional testing of this hypothesis.

Title: Tackling phosphorus pollution with biochar: A sustainable solution for agriculture

Primary Author: Temitope Popoola

Additional Authors: Rishi Prasad;Prasenjit Ray;Debolina Chakraborty;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Phosphorous (P) runoff from agricultural land is a leading cause of water pollution, accelerating eutrophication and threatening aquatic ecosystems. Current nutrient management strategies struggle to balance P retention for crop productivity while minimizing its environmental impact. This research investigates biochar as a dual-function material that not only reduces excess P loadings from runoff through adsorption but also controls its release for sustainable agricultural use. By optimizing biochar properties, this study aimed to enhance P sorption efficiency and regulate its desorption. Hence, ensuring its availability when crops need it while preventing excessive losses to water bodies. The study explored the adsorption and desorption behavior of P using pristine, modified, and engineered biochar derived from pine wood. A batch sorption isotherm experiment was conducted and measured using the Langmuir isotherm equation to derive the sorption maximum (Smax), bonding energy (k), P saturation, and maximum buffering capacity. The controlled release potential of biochar-bound P was assessed through seven successive desorption studies using the highest concentration of sorbed P. The outcome of the study showed that the engineered biochar exhibited the highest P affinity compared to the modified and pristine biochar. In addition, it significantly reduces water-extractable P concentration while allowing gradual P release. This study offers a cost-effective approach to mitigating agricultural P runoff. The implementation of biochar-based solutions can enhance soil fertility, reduce reliance on synthetic fertilizers, mitigate greenhouse gases, sequester carbon, and improve water quality. Overall, this research supports sustainable agriculture and addresses critical environmental challenges.

Title: Influence of Genetic Factors, Pathogen Lifecycle Strategies on Plant Disease Severity

Primary Author: Temitope Ruth Folorunso

Additional Authors: Janna Willoughby;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Pathogenicity of phytopathogenic fungi (PF) in host plants is influenced by primary virulence factors that interconnected to determine the outcome of disease. The activities of these factors determine the timing and frequency of plant host colonization as well as disease severity in affected host tissue. In this study, we comprehensively analyze the molecular role of pathogen virulence factor, lifecycle and environmental factors in the disease severity outcomes. We collected published data resulting in over 500 datapoints, used Cohen's d to calculate the effect size and used ridge regression to identify the association between specific pathogen traits and disease severity. In the predictors of disease severity, varying trends of disease outcome was found for disease severity (lesion size and disease index).We found that plant-pathogen interactions were shaped by virulence factors, pathogen lifecycle strategies, infection sites, and transmission modes. Biotrophic pathogens had a significant positive association with increased disease severity (scaled estimate = 4.690, $t = 5.08$, $p < 0.001$) and enzymes were significantly associated with increased lesion size (scaled estimate = 14.045, $t = 2.894$, $p = 0.004$), suggesting a consistent in influencing this outcome compared to transcription factors and effectors. Our findings highlight the multifaceted nature of disease severity in plant-pathogen systems, shaped by gene expression, pathogen taxonomy, and transmission factors. The interplay among these factors highlights the importance of considering multiple levels of biological and ecological organization when studying pathogen-host interactions.

Title: Identifying maximum growth efficiency media for the fungal pathogen Lecanosticta acicola and effects on high molecular weight DNA extraction

Primary Author: Tess Lindow

Additional Authors:

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Lecanosticta acicola is a pathogenic fungi that causes brown spot needle blight in pine tree species. L. acicola is capable of infecting at least 53 Pinus species worldwide, leading to stunted growth and mortality. Because pines are major contributors in forestry and agriculture, damage of stands caused by these infections results in significant economic damage to the forestry industry. Therefore, understanding how this pathogen is transmitted and evolves is essential for mitigating these negative effects. To support research efforts, growing this fungus in cultured media is required. The goal of this study was to quantify the growth rates and morphological characteristics of L. acicola across different culture media (solid and liquid) and determine which DNA extraction protocol yielded the highest quality DNA. To achieve this, we first measured fungal growth on four culture media for three consecutive weeks. For solid media, photos of each culture were captured and analyzed using ImageJ to quantify area of growth. Using the resulting fungal samples, we tested DNA extraction using four methods. We compared effectiveness by measuring DNA concentration and purity using the Quantus Fluorometer and Nanodrop spectrophotometer. The four extraction protocols are as follows: CTAB 2%, High Salt CTAB 3% +PVP-10, SDS 1% +CTAB CTAB 3% + 1 % SDS, and Qiagen DNeasy Plant Pro kit. Our ANOVA analysis included wide variation across the four methods. For DNA purity, our second protocol was statistically significant (p= 0.02831). For DNA concentration, our fourth protocol yielded significant results (p= 0.00123). These outcomes will support future efforts in L. acicola research designed to mitigate the negative effects of brown spot needle blight disease.

Title: Development of anti-B7H3 CAR T cells for treatment of osteosarcoma in a canine model

Primary Author: Theresa Higgins

Additional Authors: Payal Agarwal;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Osteosarcoma (OS) is a highly metastatic and difficult-to-treat bone cancer that, in humans, predominantly affects children and adolescents, but also spontaneously occurs in dogs. Despite the current treatments of chemotherapy and radiation, prognosis is still poor, and there are low patient five-year survival rates in humans and even lower one-year survival rates in dogs. Therefore, novel treatments are critical to explore to improve treatment options. Chimeric Antigen Receptor (CAR) T cells are re-programmed to target cancer-specific receptors and have shown immense promise in the treatment of lymphomas and leukemias. However, their effects in solid tumors are still being explored. We are developing CAR T cells against the surface receptor B7H3 (anti-B7H3 CAR T cells), which is upregulated in malignant tumors, such as osteosarcoma, which we hypothesize will be able to lyse osteosarcoma cells in a canine model. We have successfully isolated and activated canine T cells using anti-CD3 and anti-CD28 antibodies and will transduce these activated cells with anti-B7H3 scfv encoding retrovirus. The cytotoxic effects will be observed in both 2D and 3D cell cultures in four separate GFP-luciferase-expressing canine osteosarcoma cell lines (D17, CF11, MCKOS, and D22) using fluorescent microscopy and luminescence assays. We expect this study to provide insight into improving canine osteosarcoma treatment as well as the potential for translational impacts in human medicine.

Title: Peak ground reaction force during the normal and staggered stance 5-repetition sit-to-stand is associated with step width during overground walking

Primary Author: Thomas Williams

Additional Authors: Kenneth Harrison;Bria Smith;Grant Renfrow;Aubrey Harrell;Jacob Jerkins;Jaimie Roper;Brandon Peoples;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Many people assume that mobility-disability only affects older adults. However, statistics show that 1 in 4 adults aged 18-44 experience physical disabilities, with 12.1% reporting difficulties climbing stairs or walking. Furthermore, older adults with lower peak ground reaction force (pGRF) during the Five-repetition sit-to-stand (5xSTS) are at an increased risk of disability and 4.4 times more likely to experience functional limitations within four years of assessment. This evidence highlights the importance of preserving strength to prevent mobility-disability. Therefore, this study investigates if unilateral and bilateral 5xSTS peak forces are associated with overground walking parameters. Six adults (3 males) aged 18 to 27 participated in this study. Participants completed two trials of four conditions (normal with and without a heel raise, staggered with their dominant leg forward, and staggered with their non-dominant leg forward) of the 5xSTS using marker-based motion capture. Participants were instructed to perform the 5xSTS as quickly as possible. pGRF was extracted from the ascent during the 5xSTS using in-ground force plates, and overground walking parameters during self-selected walking speed were calculated in MATLAB. Pearson’s correlation analysis was used to assess the relationship between outcomes. Our analysis revealed that pGRF during two 5xSTS conditions, normal stance and staggered stance with the dominant leg forward, is strongly associated with increases in step width during overground walking ($r = .93$)

Title: Anemia and Health in enslaved Africans from Newton Plantation, Barbados

Primary Author: Toni Lee

Additional Authors:

Department/Program: Sociology

College: College of Liberal Arts

Abstract: Bioarchaeology is the reconstruction and interpretation of health from the recovered remains of populations in the past (Larsen, 2015.) These types of studies are vital for understanding the health and history of subjugated groups, such as enslaved Africans of the 16th-19th centuries. In this study, I will be examining skeletal remains from a group of formerly enslaved Africans from Newton Plantation, Barbados. Cranial porous lesions (CPL) are widely used as a measure of anemia in bioarchaeological studies. Anemia can be used to indicate population health because it can be acquired during the lifetime due to nutrient deficiencies and poor health. For this study, I used a new method by Rinaldo et al. (2019) for scoring porous cranial lesions for lesion severity and degree of healing macroscopically. I subsequently scored each element microscopically (≈30X) for comparison, which resulted in a similar score macroscopically and microscopically 40% of the time. Severity scores in frontal and parietal bones were higher microscopically on average than occipital bones. Healing was higher microscopically except for the occipital region, many of which had surface discoloration that was not due to lesions. Microscopic analysis also revealed rounded and closing edges indicative of healing. Scoring differences between macro and micro approaches averaged 5%-25%, depending on the region of the cranium. Out of 70 scores, 18.57% differed by more than one degree, and these should be used as indications of potential error and be rescored. Replicability of frequency counts improved when using microscopic images and a multipoint tool rather than counting macroscopically. Results suggest that combining macroscopic and microscopic techniques allows greater refinement of the Rinaldo et al. (2019) evaluation criteria. Ultimately, information on anemia and other stress indicators can provide insight into the undocumented aspects of life in past populations.

Title: The power of transparency: Influencing consumer behavior in sustainable fashion

Primary Author: Ummey Hani Barsha

Additional Authors: Veena Chattaraman;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This study aimed to investigate the effect of product transparency on consumer behavior towards sustainable fashion by integrating signaling theory and the elaboration likelihood model. The study was developed in Qualtrics by modifying preexisting instruments and administered through Prolific. A pretest was conducted before the main study to select the stimuli, and a between-subject experimental design was used for the main study. The stimuli were replica layout pages of a retail website for fashion products, and participants were randomly assigned to the stimuli. A total of 200 valid responses were used to analyze the data. The finding of the study shows that the greater transparency provided by the retailers leads to increased trust, purchase intentions, and perceived value by reducing information asymmetry. Transparency significantly enhances brand trust and green perceived value, with clear sustainability disclosures improving product value perception. Brand trust and GPV fully mediate the relationship between openness and positive consumer outcomes, demonstrating how transparency fosters favorable brand attitudes. Brands can use these findings to promote their sustainability efforts, while consumers will be able to trust the brand more by verifying the information. The results also show the importance of sustainability knowledge and product involvement; knowledgeable consumers scrutinize claims, while less knowledgeable consumers rely on superficial cues. Brands can use this information to make a strategy for promoting their sustainability efforts to engage both critical thinkers and those processing information peripherally. This study offers important insights for promoting sustainability through the band and also a way to earn trust from the consumers.

Title: Evaluating Nitrogen Losses in Winter Wheat Using DSSAT-CERES-Wheat Model on Commercial Row Crop Farm

Primary Author: Vaibhav Balasaheb Shelar

Additional Authors: Arpita Sharma;Anh Nguyen;

Department/Program: Agronomy and Soils

College: College of Agriculture

Abstract: Nitrogen (N) plays a critical role in modern agriculture. Agriculture significantly contributes to N loading in groundwater and the environment. Worldwide N use efficiency for wheat (Triticum aestivum L.) is only 33%. Therefore, it is important to understand the N losses in row crop systems, primarily in winter wheat, which receives over 762 mm of rainfall in Alabama. However, quantifying N losses through volatilization, leaching, runoff, and denitrification is challenging and requires expensive and sophisticated instrumentation. It is hypothesized that the winter rains lead to significant N losses through leaching and runoff. In this context, the DSSAT-CERES-Wheat model can assist in providing an estimate of N loss upon satisfactory calibration and evaluation of selected plant and soil parameters. An experiment was conducted on a commercial row crop farm in Lawrence County, North Alabama, to investigate the N losses in winter wheat production. The farm has two watersheds of 26 (watershed-1) and 92 acres (watershed-2) which are further divided into high (HYZ) and low-yielding zones (LYZ) based on multiple years of yield monitoring data. The in-season crop biomass and soil samples were collected to calibrate the genetic coefficients of the wheat model and to simulate the N losses in winter wheat. The preliminary results from model estimations indicated that the dominant N loss pathway was leaching (50 kg N/ha), followed by the volatilization losses (1 kg N/ha). Field observations revealed that plants recovered 46% (128 kg N/ha) of the total N input (278 kg N/ha), while 23% was lost through various N-loss pathways. The observed runoff losses accounted for 3.07 kg N/ha. Further, the model will be evaluated to simulate different N management practices in the winter wheat to improve our understanding of N losses and help identify the best management practices to reduce the losses and improve the N use efficiency.

Title: Fabrication and Characterization of Crosslinked Nanocellulose Beads Using Cationic Metal Salts

Primary Author: Valentina Flammini

Additional Authors: Adriana Restrepo Osorio;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Nanocellulose is an abundant and biodegradable natural resource that has many leading applications in food preservation, packaging, drug delivery, energy storage, and as carries for agrochemicals. This work is focused on improving the application of agrochemicals in the agriculture sector. Most agrochemicals that are applied do not go directly to the intended target instead pollute the environment. Commercial controlled release agrochemicals do reduce excessive overuse yet disintegrate leaving microplastics and toxic chemicals in the soil with the crops. The possible solution hinders the fabrication and characterization of a biodegradable delivery platform, beads, made from nanocellulose material that is crosslinked with cationic solutions to have the capability to store agrochemicals for control-slow release. The effect on cationic strengths and molarity in coagulation bath solutions to crosslink with 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO)-mediated oxidized cellulose nanofibers to produce hydrogel beads are analyzed through preliminary experiments. The cationic trivalent metal salts, Aluminum Nitrate and Ferric Nitrate, were prepared in individual solutions with molarities of 2 M, 3 M, and 4 M for comparison when incorporated with the nanocellulose material, TEMPO-CNF, at concentrations of 0.93 wt.% and 1.7 wt.%. The concept is to identify the optimal fabrication of a bead under these conditions to further be loaded with agrochemical to favor better behavior as a delivery platform for control slow-release agrochemicals. Characterization of the different trials of bead fabrication indicated that the firmness of the bead increased with both the molarity of salt in the coagulation bath and with the increase in weight percent of the TEMPO-CNF. The firmness of the beads was assessed qualitatively by the amount of weight the beads could resist before the structure collapsed. The morphology of the beads was characterized by SEM. Using FTIR and TGA composition of the beads along with the interaction between the crosslinker and the nanocellulose material was determined. The result of the characterization offers the possibility to define parameters in the fabrication of beads using an abundant, biodegradable source material (cellulose) and cationic metal salt solutions to compatibly replace the delivery platform of control slow-release agrochemicals composed of microplastics and toxins.

Title: Interferon beta stimulation of 3D trophoblast spheroids reveals differences in immune responses between cell types

Primary Author: Victoria Caravaggio

Additional Authors: Rachel West;Cristine Camp;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: The uterus must maintain a delicate balance of immune activation and quiescence during early pregnancy to facilitate the implantation and development of the embryo and placenta. Inflammatory cytokines are necessary for implantation, but a dysregulated response can cause implantation failure and pregnancy loss. In this study, we aimed to use a 3-dimensional (3D) spheroid model of trophoblast (placental) stem cells to recapitulate the peri-implantation placental immune response. We grew trophoblast stem cells (TSCs) in 3D stem conditions. We also differentiated TSC spheroids towards the syncytiotrophoblast (STB) lineage, as this lineage comes into direct contact with maternal tissues. Spheroids were treated with 250 U/mL of interferon beta (IFNB) for 8 hours, then collected RNA, and RT-qPCR performed to quantify levels of interferon stimulated genes (ISGs). Interestingly, while the IFNB treated TSCs and STBs had significantly higher levels of ISGs, the treated STB spheroids had significantly elevated levels of ISG15 ($p<0.0001$), ISG20 ($p<0.01$), IFITM2 ($p<0.01$), and IFITM3 ($p<0.01$) compared to the treated TSC spheroids, suggesting a more robust antiviral response in STB cells. We next performed RNA-sequencing which further demonstrated differences between TSC and STB spheroids. Gene ontology revealed pathways related to inflammation like NFκB signaling and regulation of the inflammatory response were enriched in the TSC spheroids, whereas pathways related to cell proliferation were decreased. The STBs had a stronger antiviral response to IFNB stimulation with pathways related to response to viruses and response to interferons enriched, suggesting that STBs have a more powerful anti-viral response than the TSCs. The robust increase of ISGs and immune response pathways after immune stimulation indicate that STBs readily respond to IFNB, suggesting that the STB provides a powerful frontline defense against immune stressors, protecting the placenta and fetus from infection.

Title: Fluorescence behavior of probe molecules in model aerosol constituents

Primary Author: Victoria Cover

Additional Authors: Paul Ohno;Michael Boadu;Angel Gibbons;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Respiratory viruses are a subject of public health concern and can be transmitted via aerosol particles. These particles are susceptible to physicochemical changes in response to the environmental conditions, such as temperature or relative humidity, which impact virus viability. A mechanistic understanding of these effects requires in situ measurements of these physicochemical properties, which remains challenging. Fluorescence measurements coupled with polarity, viscosity, or pH-sensitive fluorescent probes are one of the few methods capable of in situ measurements of these properties in aerosols. However, accurate assessment of aerosol chemical environments requires a comprehensive understanding of probe molecule behavior in these environments, which are typically characterized by high salt concentrations. Here, absorbance and fluorescence measurements of several common probe molecules including Nile Red, Prodan, 3-Hydroxychromone, and Pyranine in organic/inorganic model aerosol environments are presented. Additionally, a range of probe molecule behaviors, such as aggregation, pH response, and ionic strength response have all been investigated. The outlook of using these and other probe molecules in future studies of aerosol physicochemical properties is discussed.

Title: Examining the Barriers to Entry for Third-Party Logging Truck Drivers in the Southeastern United States

Primary Author: Vida Owusu

Additional Authors:

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: The log trucking industry is essential to the forestry sector, yet barriers such as high equipment costs, fluctuating insurance premiums, and regulatory constraints hinder efficiency, particularly for contract and third-party drivers, contributing to labor shortages and inefficiencies in the timber supply chain.This study examines the financial, operational, and regulatory challenges faced by company-employed, contract, and third-party log truck drivers in the Southeastern United States. Using a mixed-methods approach, this study will assess these challenges through surveys of 300 log truck drivers and interviews with industry stakeholders. The findings will inform policy recommendations for workforce development, operational efficiency, and regulatory reform, ultimately supporting workforce sustainability, economic stability, and the resilience of the Southeastern U.S. logging industry.

Title: Determining Hot Wall Impact and Heat Transfer Regimes Using a Fast Surface Thermocouple for Impingement of Single Drops

Primary Author: Vijayananda Devananda

Additional Authors:

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: The study of the interaction between liquid droplets and a heated solid surface has been of prime importance due to its wide applications such as internal combustion engines, where the impact regime of fuel droplets on hot components can dramatically alter mixing and ignition behavior. Determination of the heat transfer regime is often done through visual observation (e.g. by imaging through a transparent wall substrate) for impinging single droplets, but at even moderate density this approach is challenging. In this work, single drops are incident on a stainless-steel wall with temperatures spanning 300-800 K at varying Weber number. The temperature at the solid wall is measured using a surface junction K-type thermocouple. Simultaneous observation with high-speed backlit imaging allows for comparison of heat flux with the drop impact regime. Using a semi-infinite conduction problem, thermocouple data is used to estimate the wall heat flux for various conditions spanning the Leidenfrost temperature. These results are key for validation of spray-wall modeling, where the role of multi-drop impingement at engine relevant condition is challenging due to the challenge of visual observation and the rapid dynamics of drop-wall and spray-wall dynamics.

Title: 3D-Printed Brace Utilization for an Isolated Fibular Head Fracture: A Case Report

Primary Author: Vincent Lee

Additional Authors: Ji Lee;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Introduction: Isolated fibular head fractures are rare and often go undiagnosed on initial imaging, leading to delayed treatment. Traditional management strategies may not adequately protect the fracture site without unnecessarily restricting mobility, warranting alternative solutions. Relevance / Significance: Unlike distal fibular fractures that affect ankle stability, fibular head fractures do not require immobilization. However, without proper protection, incidental trauma can delay healing. A targeted, non-restrictive approach can optimize recovery. Approach / Methodology: A 65-year-old male sustained an isolated fibular head fracture from a cow's kick. Initial X-rays were inconclusive, but MRI confirmed the diagnosis. A custom 3D-printed brace was designed to shield the fracture from external forces while allowing mobility. It was used alongside a walking boot and crutches. Results: The patient fully recovered without complications. Follow-up imaging at 10 weeks confirmed proper healing, and the patient resumed normal activities. This case demonstrates the potential of 3D-printed bracing as a protective, non-restrictive alternative to traditional management, enhancing recovery while minimizing the risk of further trauma.

Title: ERBB4 heterodimers drive BRAF WT melanoma cell lines

Primary Author: Vipasha Dwivedi

Additional Authors: David Riese;Douglas Woodall;Emily Allen;Erin Harrell;Kaitlyn O'Daniel;Chloe Dion;Joelle Woggerman;Lauren Lucas;Teigen Nelson;Rees Cooke;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Metastatic melanomas that possess wild-type (WT) B-Raf Proto-Oncogene, Serine/Threonine Kinase (BRAF) alleles ("BRAF-WT melanomas") are just as aggressive as melanomas that harbor gain-of-function mutant (e.g., V600E) BRAF alleles. Moreover, no targets for effective chemotherapeutic intervention (other than immune checkpoint inhibitors) have been identified for BRAF-WT melanomas. Thus, we aim to identify targets for therapeutic intervention in these tumors. ERBB4 (HER4) protein encodes a receptor tyrosine kinase closely related to the epidermal growth factor receptor (EGFR/ERBB1), ERBB2, and ERBB3. We have previously demonstrated that ERBB4 is both sufficient and necessary for the proliferation of BRAF-WT melanoma cell lines. However, the constitutively homodimerized ERBB4 Q646C mutant protein inhibits the proliferation of BRAF-WT melanoma cell lines. Moreover, we have demonstrated that ERBB4-EGFR and ERBB4-ERBB2 heterodimers stimulate proliferation and other oncogenic phenotypes in various tumor model systems. Hence, in this work, we have tested the hypothesis that ERBB4-EGFR or ERBB4-ERBB2 heterodimers drive BRAF-WT melanomas. We show that blocking ERBB2 signaling using a dominant-negative ERBB2 mutant allele inhibits proliferation by three ERBB4-dependent BRAF-WT melanoma cell lines, indicating that ERBB4-dependent BRAF-WT melanoma cell lines are also ERBB2 dependent. We are attempting to translate this finding into therapeutic practice by testing the activity of the FDA-approved EGFR/ERBB2/ERBB4 inhibitor afatinib in ERBB4- and ERBB2-dependent BRAF-WT melanoma cell lines. Positive findings would compel us to strongly advocate for the rapid advancement of this therapy in clinical practice.

Title: Evaluation of modified pinewood biochar for dissolved reactive phosphorous removal from different simulated water-phosphorous systems.

Primary Author: Vivian Chimezie Usha

Additional Authors: Sushil Adhikari;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: One potential solution to eutrophication involves converting woody biomass waste into engineered biochar product capable of reducing phosphorus (P) levels in post-secondary wastewater treatment systems. The use of metal oxide- based adsorbents (such as magnesium oxide (MgO) and calcium oxide (CaO)) in nutrient (such as P) management has been widely researched. However, studies on pinewood biochar modified with MgO and MgO-CaO hybrids (derived from their metal hydroxide precursors) for removing various dissolved phosphate forms remain limited. This study investigates the P removal capacity of modified pinewood biochar (PB) that was produced via co-pyrolysis of pinewood with 2% of metal hydroxides of magnesium (Mg), calcium (Ca), and their combination at 450^{o}C for 2 h in a tube furnace to obtain MgO-PB, CaO-PB, and MgO/CaO-PB, respectively. An evaluation was conducted to determine the most efficient biochar for phosphorous removal from different P solutions simulating real wastewater systems. The P solutions were prepared using H2PO4-, HPO42-, and their combinations within a concentration range of 10-100mg/L. All Mg-containing biochar showed high phosphorous removal capacity in the ~20-24mg/g range for different simulated water-phosphorus systems for a pH range of ~5 – 9 with a maximum removal efficiency of ~99% for the three water-phosphorous systems. However, MgO-PB, as compared to its combination (MgO/CaO-PB) was more efficient in dissolved reactive phosphorous removal, and its isotherm studies show a maximum adsorption capacity of 31.59mg/g for H2PO4- and HPO42-, and 36.34mg/g for H2PO4-/HPO42 water-phosphorous systems using a non-linear Langmuir model with an R2 value of 0.95 and 0.87 respectively. These findings highlight the potential of MgO-PB as an effective solution for reducing phosphorus loads in post-secondary wastewater treatment systems.

Title: Characterization of Inline Heater for Flight Conditions with Solid Fuel Burner

Primary Author: Vivian Wu

Additional Authors: James Michael;Michael Welch;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract:

Title: Tuning polar E-H bond activation with a Cobalt(II) complex bearing a non-trigonal phosphorus center

Primary Author: W A A Pamodya Weerasuriya

Additional Authors: Ethan Hill;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Second-row transition metals have been the preferred choice for activating polar E-H bonds (O-H, S-H, B-H and N-H). However, their scarcity and high cost have driven interest in more economical alternatives. A promising strategy involves employing first-row transition metals alongside metal-ligand cooperativity. While E-H bond activation typically follows a two-electron mechanism, first-row metals often exhibit a preference for single electron pathways. Nevertheless, with strategic ligand design, these metals can be tuned to facilitate two-electron processes. This study explores the synthesis of a cobalt(II) complex featuring a non-trigonal phosphorus center. Non-trigonal phosphorus compounds are known to independently activate E-H bonds due to their ambiphilic nature. Our goal was to determine whether a non-trigonal phosphorus ligand, when coordinated to a first-row metal, could cooperatively activate polar bonds. We present the synthesis and characterization of a novel cobalt(II) complex, K[Co(3Nurea)(OAc)], which incorporates a urea-based ligand bearing a non-trigonal phosphorus center directly bound to cobalt. Comprehensive spectroscopic analysis provides insight into its structural features, while its reactivity towards polar bonds such as B-H, Si-H, and O-H is investigated. Additionally, we examine its potential for transferring the E-H moiety to unsaturated substrates. By integrating non-trigonal phosphorus chemistry with metal-ligand cooperativity, this work offers new opportunities for catalyst development targeting the activation of challenging substrates.

Title: TopoQual corrects long-read sequences and recalibrates quality scores to enhance somatic mutation detection.

Primary Author: Weerakoon Weerakoon

Additional Authors: William Heaton;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Pacific Biosciences (PacBio) circular consensus sequencing (CCS), also known as high fidelity (HiFi) technology, has revolutionized modern genomics by producing long (10 + kb) and highly accurate reads. This is achieved by sequencing circularized DNA molecules multiple times and combining them into a consensus sequence. Currently, the accuracy and quality value estimation provided by HiFi technology are more than sufficient for applications such as genome assembly and germline variant calling. However, there are limitations in the accuracy of the estimated quality scores when it comes to somatic variant calling on single reads. To address the challenge of inaccurate quality scores for somatic variant calling, we introduce TopoQual, a novel tool designed to enhance the accuracy of base quality predictions. TopoQual leverages techniques including partial order alignments (POA), topologically parallel bases, and deep learning algorithms to polish consensus sequences. Our results demonstrate that TopoQual corrects approximately 31.9% of errors in PacBio consensus sequences. Additionally, it validates base qualities up to q59, which corresponds to one error in 0.9 million bases. These improvements will significantly enhance the reliability of somatic variant calling using HiFi data. TopoQual represents a significant advancement in genomics by improving the accuracy of base quality predictions for PacBio HiFi sequencing data. By correcting a substantial proportion of errors and achieving high base quality validation, TopoQual enables confident and accurate somatic variant calling. This tool not only addresses a critical limitation of current HiFi technology but also opens new possibilities for precise genomic analysis in various research and clinical applications.

Title: Drone-based inter-seeding of cover crop for late-season and post-harvest weed suppression in Southern Alabama cotton production systems

Primary Author: Wilfried Ouedraogo

Additional Authors: Aniruddha Maity;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Cotton plants must be defoliated before harvest to prevent plant debris from contaminating the lint. While defoliation removes cotton foliage and makes the mechanical harvest of cotton significantly convenient, it also allows late-season weeds to resurge and capture the empty space in the field. This leads to the depletion of farm resources and huge enrichment in the soil seed bank with weeds. In this context, various management approaches have been developed, with herbicide application being the most used strategy. However, as herbicide resistance continues to grow, alternative integrated weed management strategies are urgently needed. Inter-seeding cover crop species in cotton may improve the late-season weed control efficiency while maintaining all other benefits of cover crop. Despite previous research on cover cropping, limited studies have explored drone-based inter-seeding as an effective weed management solution. This study aims to determine the optimal timing and rate for drone-based cover crop application to enhance late-season weed control in Southern Alabama cotton production systems. It will demonstrate the feasibility and effectiveness of drone-seeded cover crops, offering valuable insights for sustainable weed management in cotton production.

Title: Investigating the role of elongation factor P in iron deficiency in Bacillus subtilis

Primary Author: William Lee

Additional Authors: Rodney Tollerson;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Elongation Factor P (EF-P) is a ribosomal protein that facilitates the translation of polyproline motifs (PPX), preventing ribosomal stalling. While its role has been studied in various organisms, its impact on community dynamics remains unexplored. The yfhA gene in Bacillus subtilis encodes a membrane protein involved in xenosiderophore uptake under iron-deficient conditions, regulated by FUR and expressed only in such environments. This ABC transporter specifically imports schizokinen, a siderophore produced by Priestia megaterium. Iron deficiency is a common environmental challenge, as less than 1% of soil iron is bioavailable despite its abundance. My research demonstrates B. subtilis growth under iron-deficient conditions with and without EF-P and schizokinen, suggesting a regulatory role for EF-P. To further investigate, I developed strains with GFP and FLAG tags, altered polyproline residues, and examined membrane protein insertion efficiency. Fluorescence studies quantified transporter production under iron-limited conditions, providing insights into EF-P's regulatory and functional roles in siderophore uptake.

Title: Multi-scale simulations of SdrG:Fgβ: Bridging experimental and computational force spectroscopy

Primary Author: William Oliveira Sote

Additional Authors: Priscila da Silva Figueiredo Celestino Gomes;Rafael Bernardi;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Staphylococci bacteria use an arsenal of virulence factors, mainly composed of proteins such as adhesins, to target and adhere to their host. Adhesins play critical roles during infection, mainly during the early steps of adhesion when cells are exposed to high mechanical stress. S. epidermidis SdrG:Fgβ force resilience has been investigated using atomic force microscopy (AFM)-based single molecule force spectroscopy experiments paired with steered molecular dynamics (SMD) simulations. However, there is still a gap between both kinds of experiments at high force-loading rates. Here, we leveraged the high-speed of coarse-grained (CG) SMD simulations to bridge the gap between the data obtained in vitro and in silico with all-atom SMD. Pulling experiments were conducted at velocities ranging from 10-4 to 10-8 nm ps-1. The CG-SMD data was fitted to the all-atom SMD data by rescaling their overlapping pulling rates to the lowest overlapping rate. The Dudko-Humer-Szabo (DHS) theory was applied to correlate the two types of SMD simulations, yielding predictions that were consistent with both the theory and experimentation, thus demonstrating the viability of a multi-scale in silico approach. When associated with all-atom SMD, coarse-grained SMD can be a powerful ally to help explain and complement the results of single-molecule force spectroscopy experiments. Given the severity of hospital-acquired infections caused by the mechanostability of bacterial pathogens like Staphylococci, developing methodologies to better understand the adhesion process provides valuable insights that could impact the development of new therapeutic approaches.

Title: Assessing Nutrient Leaching in young peach trees: Impacts on Growth and Development

Primary Author: Winfred Nziku

Additional Authors: Melba Salazar-Gutierrez;Audrey Gamble;Edgar Vinson;Bernardo Chaves-Cordoba;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Nutrient leaching has been a long-standing concern due to its potential detrimental effects on the environment, human health, and aquatic ecosystems. This issue is becoming increasingly pressing in light of the growing challenges presented by climate variability and extreme weather events. For this study, three peach cultivars (Prunus persica L.), including 'Crimson Joy', 'Liberty Joy', and 'Rich Joy', were planted at Auburn University's Research and Extension Center in Chilton, Clanton, Alabama, on February 23, 2024, using a Randomized Complete Block Design (RCBD) with four blocks. Each block consists of 9 peach trees, totaling 36 trees. The aim of this study is to evaluate the impacts of nutrient leaching on the growth of three distinct young peach cultivars, using recommended fertilization rate (by The Southeastern peach guide). A soil sampling method is used to compare the nutrient levels at selected depths. The soil depths are 25.4 and 50.8 cm (10 and 20 in) within and 76.2 and 101.6 cm (30 and 40 in) below the peach tree root zone. The collected soil samples are analyzed for Nitrate Nitrogen (NO3-N (mg/kg)), Ammonium nitrogen (NH4-N (mg/kg)) and pH. Additionally, the young peach trees are assessed by measuring plant height (cm), trunk cross-sectional area (cm2) and annual leaf nitrogen analysis (%). The preliminary results of this study, which is still in progress indicate that both depth and cultivar significantly influence NH4-N concentrations over time, while rainfall events and cultivar interactions affect NO3-N leaching dynamics. Although pH levels changed, they did not differ statistically. Each cultivar exhibited similar TCSA increases and height growth, with all cultivars maintaining leaf nitrogen levels within the optimum range. Therefore, this study seeks to help the Alabama peach growers to understand the impacts of nutrient leaching and use better alternatives that can help to not only get maximum profit economically but also ensure that the environment is safe and sound for the current and future generations.

Title: Development of an Integrated Microfluidic Chip for CAR T-Cell Therapy: A Preclinical Trial-on-Chip Tool

Primary Author: Xuejia Kang

Additional Authors: Jayachandra Ramapuram;Siqi Wu;Peizhen Sun;Shuai Wu;Lang Zhou;

Department/Program: Materials Engineering

College: Samuel Ginn College of Engineering

Abstract: Chimeric antigen receptor (CAR) T-cell therapy has demonstrated remarkable efficacy in treating leukemia but is often accompanied by severe side effects, such as cytokine release syndrome (CRS) and immune effector cell-associated neurotoxicity syndrome (ICANS). Additionally, existing preclinical evaluation platforms inadequately mimic the human tumor microenvironment, prolonging development timelines and escalating costs. To address these challenges, we have developed a novel integrated microfluidic platform that faithfully recapitulates tumor niches, enabling precise modeling of CAR T-cell therapy. This advanced chip incorporates key pathophysiological elements, facilitating spatiotemporal monitoring of CAR T-cell functionalities, including T-cell extravasation, target recognition, and leukemia cell eradication. Furthermore, the platform supports the investigation of immune interactions with other cell types, such as monocytes, neutrophils, and natural killer cells, offering a robust model for studying therapy-induced side effects. An integrated biosensor provides real-time cytokine detection, delivering critical insights into cytokine dynamics across therapy stages, such as remission, resistance, and relapse. Moreover, the platform enables the observation of neuronal tolerance disruptions during CRS and ICANS-like scenarios, enhancing the understanding of therapy-associated neurotoxicity. This microfluidic chip represents a transformative tool for advancing CAR T-cell therapy by improving preclinical evaluation, accelerating development, and mitigating side effects. This cutting-edge tool not only shortens the timeline and reduces costs associated with CAR T-cell therapy development but also enhances the physiological relevance of preclinical evaluations. The implementation of this '(pre-)clinical-trial-on-chip' platform promises to revolutionize CAR T-cell therapy by facilitating the development of personalized therapies and informing clinical decision-making processes. Our findings suggest a transformative step forward in the optimization and safety profiling of CAR T-cell therapies.

Title: Extracellular vesicle delivery of oligonucleotide antiviral therapy against rabies encephalitis

Primary Author: Yanthrawaduge Fernando

Additional Authors: Maria Naskou;Douglas Martin;Henry Baker;Anna Cochran;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Zoonotic rabies virus (RABV), can cause lethal and incurable viral encephalitis in humans, and is invariably fatal. Although there are preventable measures, currently there is no effective treatment or cure for encephalitic rabies, as the blood brain barrier limits the transport of treatments into the brain. Extracellular vesicles (EVs) derived from plasma membrane presents an innovative platform for developing novel therapeutics with their ability to shuttle molecules across the blood brain barrier. Moreover, RNA interference (RNAi) using synthetic short double stranded DNA (siRNA) is an innovative approach used to selectively bind targeted viral messenger RNA to induce viral mRNA degradation. Our objective is to engineer EVs to express rabies virus glycoprotein (RVG) derived peptide, to induce neuronal cell targeting, and to deliver therapeutic antiviral siRNAs into the central nervous system. We hypothesize that RVG-modified EVs will increase brain tropism and increase the efficiency of anti-viral siRNA delivery into the central nervous system to rapidly inhibit rabies virus replication. We modified EVs to express RVG by transfecting parent cells with a plasmid encoding Lamp2b-RVG or FLAG as the control. A surrogate siRNA (GAPDH) was used to evaluate the encapsulation efficiency and cargo delivery of RVG-modified EVs. Also, we screened forty-six antiviral siRNA candidates against rabies N gene for their high binding and gene inhibition in vitro using psiCHECK2 luciferase assay system and RT-PCR. Our preliminary data showed successful modification of EVs with the RVG peptide, loading and delivery of a surrogate siRNA (GAPDH) into neuronal cells. Also, data from Luciferase assay shows that six antiviral siRNAs candidates can induce more than 90% N gene interference in HEK293 cells. Next, we aim to evaluate the therapeutic effect of EVs to deliver antiviral siRNAs in rabies infected neuronal cells and mice via bio distribution and gene expression assays.

Title: Employee attitude as mediator between HRM & organizational performance

Primary Author: YASIR SHARIF

Additional Authors: ;

Department/Program: Business Administration

College: Harbert College of Business

Abstract: Attitude is a power that controls human behaviour. When employee Attitude is positive, it can give impact positive to organization performance. A proper human resource management (HRM) managed by organization, the employee attitude will be affected. HRM practices influence employee attitude positively and there is a mediating role of employee attitude between training and development dimension of HRM practices and organizational performance. Therefore, the purpose of my study is to explore employee attitude as a mediator between HRM and organizational performance. This research outcome shall reveal whether HRM practices influence employee attitude and its give impact to organizational performance for more effective and efficient in achieving organization goal or not.

Title: Personal Design Process : Designing Ergonomic and Accessible Fire Extinguisher

Primary Author: Yeongwook Shin

Additional Authors:

Department/Program: School of Industrial and Graphic Design

College: College of Architecture, Design and Construction

Abstract: This poster shows a fire extinguisher I designed as an undergraduate student, illustrating the design process I followed, the goals I aimed to achieve, and the value this design offers to users. The design process involves breaking down complex problems or ideas into manageable steps. Numerous design approaches exist, and no single methodology is universally superior. However, a structured design process helps identify problems efficiently and develop solutions. For this project, I applied a six-step design methodology to solve the problems and improve the design: 1. Identifying issues and problems with existing products such as accessibility, grip, and storage. 2. Conducting UX analysis and user research (e.g., creating personas and flow charts) 3. Researching three concepts of design 4. Develop three types of prototypes and mock-ups 5. Collecting and incorporating user feedback through prototypes 6. Producing the final mock-up The redesigned fire extinguisher has a longer handle for better grip and a flat front that can be magnetically attached to refrigerators and other home appliances for easy storage. This makes it easy for users to find and use. Through user feedback, 10 users tried out three types of prototypes and received feedback on what they liked and what they didn't like, which was used to improve the final design. Through this project, I learned the importance of user-centered design and iterative prototyping. By actively incorporating user feedback, I was able to refine the design to better meet real-world needs. The results of this study show positive responses, emphasizing several impactful improvements in the product's value. The redesigned fire extinguisher offers easier and quicker access in emergencies. Its ergonomic shape and intuitive operation make it more user-friendly than conventional models. This shows how a systematic design process can effectively contribute to designers and individuals from various problems and create meaningful solutions.

Title: Transcriptome signatures of high reproductive performance in cryopreserved blue catfish sperm

Primary Author: Ying Zhang

Additional Authors: Xu Wang;Ian Butts;Luke Roy;Rex Dunham;Thu Dunkleberger;Kyle Wood;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Catfish is the most important species in U.S. aquaculture, representing ~70% of freshwater production. Hybrids of female channel catfish (Ictalurus punctatus) and male blue catfish (I. furcatus) comprise >50% of the harvest due to their superior production traits and enhanced disease resistance. However, hybrids cannot be produced naturally, and sperm must be collected from euthanized males. Cryopreservation is widely employed for the storage of sperm for utilization during the female spawning season. This study aims to understand the molecular mechanisms underlying sperm quality and male reproductive success. Sperm samples were collected from 29 adult male blue catfish. Cryopreserved sperm was thawed and fertilized with eggs from 3 female channel catfish, and the average embryo hatch rates ranged from 14% to 63% among different males. RNA sequencing was performed to investigate the gene expression profile of the sperm samples. Differential gene expression analyses were performed to compare 4 samples with the highest hatch rate (average more than 58%) and 4 samples with a much lower hatch rate (average less than 32%). Functional enrichment analysis revealed that the 300 downregulated genes in the low hatch rate group were involved in immune response, mitochondrial respiratory chain, and DNA rearrangement and stability, suggesting potential impaired immunity and mitochondrial function. Many upregulated genes (3,550) were identified with a lower fold change compared to the downregulated ones, and they were primarily associated with apoptosis, ferroptosis, autophagy, and mitophagy, suggesting that regulated cell death mechanisms might be involved. By identifying these key genes, we can develop robust biomarkers for predicting hatch success and optimizing breeding strategies in catfish aquaculture. Our findings offer critical insights into the molecular mechanisms governing male reproductive success, facilitating the advancement of efficient hybrid catfish production.

Title: Significant enrichment of Corynebacterium in the vaginal microbiome of cows carrying persistently infected BVDV fetuses

Primary Author: Yue Zhang

Additional Authors: Xu Wang;Paul Walz;Shollie Falkenberg;Rachel Phillips;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Bovine viral diarrhea virus (BVDV) is a significant pathogen responsible for substantial economic losses in the beef and dairy cattle industries, with annual costs potentially exceeding $1 billion. Persistently infected (PI) cattle are calves who have survived early gestational in utero infection and carry the virus for life. These cattle continuously shed the virus into the environment and pose a significant risk to the health of the entire herd. Exposed animals may suffer severe and acute fever, diarrhea, pneumonia, and a prolonged, costly recovery period accompanied by dampened reproductive performance, poor growth, and reduced milk production. Abortion, infertility, as well as embryonic death related to BVD cause further economic loss. BVD control largely depends on recognition and removal of PI animals, which arise exclusively from in utero infection. The microbiome of the reproductive system plays a crucial role in maintaining reproductive health and pathogen resistance. Disruption of the vaginal microbiome, a condition known as vaginal dysbiosis, may increase susceptibility to fetal infections. However, a concrete link between vaginal dysbiosis and BVDV PI has not been established. This research aims to characterize the vaginal microbiome of cows carrying BVDV-PI and noninfected fetuses and identify the vaginal microbiome correlates in BVDV persistent infection. Vaginal swab samples were collected from cows carrying healthy (N=6) and BVDV-PI (N=6) fetuses and microbial DNA samples were extracted for whole-genome shotgun (WGS) metagenomic sequencing. Comparative analysis showed a two-fold increase in Actinobacteria abundance ($P < 0.05$) in the vaginas of cows carrying PI fetuses, which was driven by an enrichment of Corynebacterium. The observed alterations in the vaginal microbiome have significant implications for the dynamics of the microbial community and the reproductive health, which will inform the early detection and management of BVDV infections.

Title: Using a Long-Short-Term Memory Model to Classify Essential Tremor Severity

Primary Author: Zachary Miller

Additional Authors: Jaimie Roper;Kenneth Harrison;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract:

Title: Remote Sensing for Levee Systems Deformation Monitoring : From Regional Context to Local Stability

Primary Author: Zahra Ghorbani

Additional Authors: Ali Khosravi;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: This study addresses the critical need for comprehensive monitoring of aging levee infrastructure using Interferometric Synthetic Aperture Radar (InSAR) techniques. With increasing concerns about infrastructure stability and flood protection, monitoring levee systems is crucial for public safety and risk management. Focusing on two critical infrastructure sites - the Santa Margarita River levee system in California and Lake Tholocco in Alabama - we employed Sentinel-1 SAR data from 2015 to 2023. We processed the InSAR data in two resolutions to derive displacement time series and velocities. Standard resolution analysis provided broad perspectives on ground movements, while higher-resolution data offered detailed insights into localized levee behavior. For Lake Tholocco, we observed significant temporal variability in deformation patterns ranging from 8 mm/yr, with a localized subsidence area near the dam showing a rate of 7 mm/yr. Time series analysis revealed both long-term trends and seasonal fluctuations, demonstrating strong correlations with hydrometeorological variables. The Santa Margarita levee system exhibited deformation patterns with velocity ranges from 15 mm/yr and an overall subsidence trend, with displacements ranging from +5 mm to -15 mm over the study period. Localized deformation analysis of the Santa Margarita levee system revealed horizontal (East-West) deformation rates ranging from -3 to +3 mm/yr and vertical deformation rates within the same range. By integrating InSAR observations with environmental data such as precipitation, soil moisture, temperature, and water surface elevation, we found strong correlations between levee deformation and these factors, particularly soil moisture at both sites. The study highlights the importance of comprehensive monitoring strategies that consider multiple environmental variables in assessing levee stability and performance.

Title: Detecting adolescent reception of parental support in the context of peer stress: A multi-method study

Primary Author: Zeynep Su Altinoz

Additional Authors: Stephen Erath;Gregory Pettit;Jennifer Somers;Rachel Worthy;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Adolescent reception refers to attention to and positive evaluation of parental support. Although reception is a key component of support effectiveness, it is overlooked in the literature. Reception can be detected by adolescents' observed responses to parental support, adolescents' or parents' reports of reception following parental support, and their reflections about the conditions and time course of reception. We conducted a novel multi-method, multi-informant study to detect different elements of adolescent reception of parental support. The current study includes 68 parent-adolescent (Mage = 13.70 yrs., 76% White, 16% Black, 51% male) dyads. Each dyad completed two in-lab video-recorded conversations. First, adolescents were asked to prepare for a self-presentation. Before the self-presentation, adolescents and parents discussed the self-presentation for five minutes. Second, adolescents identified their most difficult peer problem and discussed it with their parents for another five minutes. For each conversation activity, we coded reception based on adolescent behaviors, such as attentiveness to the parent and showing appreciation of the parent. Reliabilities were good (ICCself-presentation = .81, ICCpeerstress = .78). In addition, adolescents completed a support reception scale following each discussion (αs' range = .68 - .77). Preliminary analyses showed that observed reception during the discussions was associated with adolescents' subjective reports of reception after the discussions (r = .40). Results support the reliability and validity of our novel observational measure of adolescent reception of parental support. Future analyses will identify themes from interviews about participants' perception of the time course of reception. Additional descriptive data and associations between different types of parental support (e.g., behavioral guidance, emotional comfort), adolescent desire for support, and adolescent reception will be presented.

Title: Evaluating changes in avian ecosystem services over time across North America

Primary Author: Zhuolin Du

Additional Authors: Christopher Lepczyk;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Birds are facing a critical survival crisis, with global avifauna abundance experiencing significant declines since the Industrial Revolution. In North America alone, bird populations have dropped by nearly 30% since 1970, equivalent to a staggering loss of almost 3 billion birds. As essential performers of ecosystem services, this dramatic decline, particularly among common bird species, has severely diminished their ecological roles. Based on birds' taxonomy, morphologies, and functional traits, predictive models are constructed to estimate the capacity of each avian species to perform two ecosystem services, which are pest control and pollination. Drawing on the published data on the avian species abundance changes in North America from 1970 to 2017, the changes in avian ecosystem services are evaluated across North America and within each breeding biome of birds, respectively. Our analysis reveals significant declines in pest control and pollination services across North America. Among breeding biomes, grasslands and forests experience the most substantial losses in pest control service, and forests also exhibit the most diminished pollination service. The study contributes to a deeper understanding of the impacts of bird declines, bridging extensive research on human activities' effects on avifauna with the ecological implications of these changes. Furthermore, it facilitates the development of biome-specific policies to maximize the effectiveness of ecosystem service restoration efforts tailored to each biome's unique circumstances.

Title: Student perceptions of societal topic integrations in STEM curricula

Primary Author: Zoe Diggs

Additional Authors: Cissy Ballen;Cathy Le;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: This study investigates how students in different STEM fields perceive the integration of societal topics into their courses. To understand these variations, we surveyed undergraduate students in biology, chemistry, and physics and gauged their perceptions of how often societal topics are currently addressed, how often they prefer them to be addressed, and the importance of this integration. The survey also asked students to identify the most relevant and interesting topics in their fields. We observed considerable variation in how students perceived the relevance of societal topics within specific STEM disciplines. While topics such as "Human Health" and "Public Trust in Science" were considered relevant across disciplines, topics such as "Ethical Use of STEM" were more emphasized in chemistry and physics. Notably, "Public Trust in Science" was a topic of interest for both chemistry and physics students. The majority of students deemed exposure to a scientific curriculum that includes societal topics as at least moderately important, with the most common benefit being increased awareness of the real-world relevance of science. However, a common concern raised by all disciplines was the limited class time. The results also show that coverage of societal topics varies significantly between fields, with physics reporting the least frequent discussions and biology reporting the most frequent. This disparity could lead to a lack of interdisciplinary connections, limiting students' understanding of how science impacts society. These findings suggest that while students acknowledge the relevance of societal topics in STEM, there is a desire to unite themes across STEM fields. This research enhances our understanding of student perceptions and preferences for integrating societal topics into science coursework, to promote inclusive educational materials and teaching strategies.