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RESEARCH
Symposium /// 2024

Tuesday, March 26, 2024

Title: Virome analysis of mosquito (culex erraticus) collected in Auburn, Alabama

Primary Author: Aasma Sharma

Additional Authors:

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Mosquitoes (Diptera: Culicidae) are a cosmopolitan insect group that has more than 3600 insect species, the majority of which are the vectors of parasites, viruses, and bacteria. They are important globally recognized vectors for many pathogens. To understand the diversity of viruses in mosquitoes in Auburn, Alabama a virome study was done on the mosquitoes collected and we submitted for RNA Miseq analysis. There were 79354626 paired end sequences, with average length 35-150 bp, GC % 45 and Phred score 36. The bioinformatics work was done in galaxy platform. First, the sequences were mapped using Bowtie2 tools to the reference genome of Culex quinquesfasciatus (GCA_015732765.1). The unmapped reads representing non-mosquito sequences were then assembled using Trinity to generate the contigs which were then annotated using Megablast. The initial finding has suggested there is a huge abundance of Merida virus sequences. This study will demonstrate the diversity of viruses that can be found in uncharacterized mosquito.

Title: Comprehensive digestive comparison of bermudagrass cultivars

Primary Author: Abbigail Hines

Additional Authors: Brandon Smith;Leanne Dillard;Kim Mullenix;Werner Bergen;Anna Underwood;Diva Rigney;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Over the last 80 years of bermudagrass (Cynodon dactylon [L.] Pers.) cultivar development, there is a lack of research comparing cultivars under in vivo (IV), in situ (IS), and in vitro (IVT) conditions of the grazing animal. Therefore, our objective was to evaluate the digestibility of four bermudagrass cultivars under IV, IS, and IVT conditions. In a Latin square design, four ruminally-fistulated heifers were randomly assigned one of four bermudagrass cultivars (Coastal [COS], Russell [RUS], Tifton 44 [T44], or Tifton 85 [T85]) for four 30-d IV periods (21-d adaptation and 9-d collection). Hay and ort samples were collected from d 14 to d 30 and total fecal samples from d 21 to 25. On d 28, rumen fluid was collected for an accompanying IVT study using a completely randomized design to include cultivar and digestibility method (Tilley and Terry [TT] or Goering and Van Soest [GVS]). On d 31 of periods 3 and 5, an accompanying IS study was conducted as a randomized complete block design to include IV diet, cultivar, and incubation timepoint. Hay, ort, and fecal samples were ground and composited based on an assumed 48-h passage rate and assayed for DMD, OMD, NDFD, ADFD, and ADLD. Data were analyzed using SAS v. 9.4. No differences were found for IV DMD, OMD, NDFD, ADFD, or ADLD ($P \geq 0.20$). However, IVDMD was greater for T85, T44, and RUS (64.6, 61.9, and 60.5%, respectively) than for COS (53.0%). Overall, TT had greater IVDMD (64.4%) than GVS (55.6%). No effect of cultivar was found on IS digestion rate (0.94%/h; $P = 0.26$) or lag time (3.2 h; $P = 0.38$). Visual appraisal of the degradation curve suggests the asymptote of digestion was not reached at 168 h. Results indicated that physiological differences between cultivars do not impact the IV cell wall digestibility of bermudagrass. Since bermudagrass likely passes the rumen before full digestion occurs, methodology selection may be critical as IVT and IS techniques may not fully represent the grazing animal.

Title: Protein localization of soybean vein necrosis virus in plant cells; *an abundant orthotospovirus*

Primary Author: Abdelaal Hamaam Abdelaal Shehata

Additional Authors: Kathleen Martin;

Department/Program: Plant Pathology

College: College of Agriculture

Abstract: Soybean *Glycine max* (L.) is an important crop grown in the United States due to its wide variety of uses. It is the fifth most popular crop produced in the state with a production of 14.55 million lbs. in 2022, and an estimated value of 206.6 million dollars. *Soybean vein necrosis virus* (SVNV) is an ambisense ssRNA virus in the genus *Orthotospovirus* and is transmitted by thrips in a persistent, propagative manner. SVNV impacts the soybean's growth, seed quality, and oil content. Symptoms of the virus include brown necrotic tissues along the major veins of the leaf. Between 2013 to 2016 the average incidence increased from 31.8%%20to 82.6%. SVNV consists of six open reading frames (ORFs) including NSs (putative silencing suppressor protein), N (nucleocapsid protein), NSm (putative movement protein), GN, and GC (glycoproteins), and the RNA-dependent RNA polymerase (L). This study is the first of its kind on SVNV providing the localization pattern of SVNV proteins in plant cells. The reference genome of SVNV (accession: GCF_004789395.1) was used to synthesize the ORFs of SVNV's five proteins (NSs, N, NSm, GN, and GC). The five ORFs were fused in frame to either GFP or RFP in N1 and C1 orientation of pSITE. The infiltration of *Agrobacterium tumefaciens* in *N. benthamiana* was used to perform a time course of images from two days post-infiltration (2dpi) to 6dpi using the fluorescence microscopy. These images revealed that NSs and N proteins localize to the cell periphery and to the nucleus. NSm causes cell death and weakly localizes to the plasmodesmata. GN and GC glycoproteins localize to the cell periphery and accumulate around the nucleus. Free-GFP was used as a negative control. These findings are essential for better understanding this emergent important orthotospovirus and providing the first steps for potential management methods.

Title: Porosity-permeability evolution due to calcite precipitation: Functionalized vs unfunctionalized 3D-printed porous media

Primary Author: Abdullah Al Nahian

Additional Authors: Lauren Beckingham;Bryan Beckingham;Harrish Kumar Senthil kumar;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Understanding the evolution of porosity and permeability in porous media is essential for assessing the long-term behavior of subsurface systems such as CO2 sequestration, geothermal energy extraction, etc. Hence, in this study, 3D-printed porous media were used to mimic the heterogeneities of natural sandstones and investigate the impact of mineral precipitation on porosity and permeability. Four samples were utilized: two unfunctionalized and two functionalized with surface acid treatment to induce mineral growth on the high-impact polystyrene (HIPS) polymer. A solution containing 0.02 M NaHCO3 and 0.02 M CaCl2 was injected at approximately 1.1 ml/min for four days to promote calcite precipitation within the samples. Differential pressures were monitored concurrently to track permeability changes over time. Post-experiment 3D X-ray Computed Tomography imaging was conducted to observe mineral growth and alterations in porosity. The results revealed reduced porosity and permeability due to calcite precipitation. Additionally, functionalized samples exhibited more remarkable mineral growth and precipitation than unfunctionalized ones, leading to a significant decline in porosity-permeability. These findings underscore the value of fabricating reactive porous media as an experimental approach to better understanding the evolution of porosity-permeability in porous media.

Title: Evaluating the effect of different soybean meal sources on feed utilization and growth performance in a controlled enclosed environment for channel catfish Ictalurus punctatus

Primary Author: Abel Paladines Parrales

Additional Authors:

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Soybean meal is among the most widely utilized plant-based ingredients in formulating feed for aquatic species. Its nutritional profile, characterized by high protein content and a favorable amino acids composition, makes it an excellent substitute for animal-based proteins. This study aimed to assess the effects of various sources of soybean meal protein, encompassing four experimental diets. The trial was conducted in a clear water recirculating system, with a stocking density of 20 fish fry per tank and an initial weight of 2.14 /- 0.03 g (Mean - SEM) for a duration of 10 weeks period. The experimental diets included those containing animal-based proteins (8% poultry meal), a basal diet comprising 56.4% soybean meal, a corn fermented protein diet, HP300, and Bright Day. All growth data collected during the trial, except for the survival rate ($p > 0.05$), showed significant differences among treatments ($p < 0.001$). Furthermore, we appreciated that the use of the Bright Day treatment exhibited good tissue development and a performance for channel catfish. Considering the results of this study, we can highlight that the use of soybean meal protein is a feasible alternative for the animal-based diets. Histological and gene sequencing studies in channel catfish will validate the dietary matrix and the interaction of their components with the physiological growth of the fish.

Title: Enhancing inclusivity of multiculturalism in international airport restaurant design: A menu of options

Primary Author: Abigail Kramer

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Airport restaurants serve a truly multicultural population; linguistic and cultural diversity coupled with stress from travel, luggage storage, and a body clock affected by time changes can impact a traveler's experience while dining in an international airport. As the world becomes more globally connected, diversity among airport restaurant patrons not only affects customer experiences but also resonates with the restaurant staff, who may encounter language barriers and struggle to navigate a floor plate cluttered with baggage. An airport restaurant designed to be culturally sensitive could increase the bottom line by providing efficient patron enjoyment that decreases the overall stress of both patron and staff, potentially helping to alleviate staff turnover by improving employee satisfaction. The purpose of this research is to develop a menu of options, including inclusive wayfinding strategies and activating the architectural foundation as universal, non-linguistic forms, that international airport restaurants can easily adapt to provide a more supportive environment for both patrons and staff. The elements proposed will be grounded in literature and precedent analysis. The proposed menu aims to contribute to the realization of airport restaurants as inclusive spaces that celebrate the diversity in global travel.

Title: High dietary salt intake induces upregulation of pro-inflammatory cytokine involved with cognitive decline within the hippocampus of rodents.

Primary Author: Abigail Law

Additional Authors: Vinicia Biancardi;Sarah Peaden;Andrew Aitken;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: An increased consumption of table salt (NaCl) has been correlated with cognitive decline and an elevated risk of dementia. However, the mechanisms are not completely known. Of late, neuroinflammation has been increasingly linked with dementia. Thus, in this work, we investigated whether a high dietary salt (HDS) intake increased pro-inflammatory cytokine within the hippocampus. We studied the effect of HDS in the expression of the pro-inflammatory cytokine IL-6 particularly, given that previous work has suggested a causal link between an elevation of IL-6 and an augmented risk for subsequent decline in cognitive function in human patients. We used male Wistar rats (150-180 g) divided into two groups: a control group that received regular water and an HSD-treated group that received 0.3 M of NaCl in drinking water for 4 weeks. At the end of treatment, animals were transcardiacally perfused with a fixative, and the brains were prepared for immunofluorescence. 30 µm sections of brain tissue containing the hippocampus were cut with a cryostat, and standard immunofluorescence was performed using an anti-IL-6 polyclonal antibody (1:100, Santa Cruz). Reactions with primary antibodies were followed by 4 hours of incubation with a fluorescently labeled secondary antibody. Stained sections were examined with a Confocal Microscope (Nikon A1). 20 consecutive optical focal planes (1-µm interval) were acquired, and a projection image was generated for quantification. The density of IL-6 staining within the hippocampus was obtained using Image J. We found that HSD-treated animals have a higher density of IL-6 staining (>15 folds) than in control rats. Our next aim is to analyze whether microglia are also activated during HSD and whether it is causally linked to the increased IL-6 observed. Our findings, while preliminary, have shown that an increase in IL-6 may be one of the mechanisms involved with the risk of dementia previously associated with an HSD.

Title: Assessing the effectiveness of an innovative two-dided drop-through photonic decontamination system in reducing salmonella

Primary Author: Abigail McConnell

Additional Authors: Dianna Bourassa;Matthew Hughes;Madalyn Jennings;Sabin Poudel;Shijina Raj Manjankattil Rajan;Montana Riggs;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: This study sought to evaluate a novel two-sided drop-through photonic decontamination system developed by PulseForge Inc. that employs pulsed light technology on whole wings and tenders and its efficacy on reducing *Salmonella* Infantis, Enterobacteriaceae, and aerobic bacteria counts. Four repetitions for a total of N=320 samples were evaluated with 8 treatments. Treatments included a control (no treatment), pulsed light treatment (PL), 30s water dip, 30s water dip with PL, 30s peracetic acid dip (PAA, 200 ppm), 30s PAA dip with PL, 3 parts simultaneously with PL, and 5 parts simultaneously with PL. Parts were inoculated with 0.1 mL of 106 *Salmonella* Infantis and 1h was allowed for attachment. Bacterial counts were log transformed and are reported as log10 CFU/mL. Data were analyzed using the general linear models procedure and means were separated by Tukey's HSD with significance at $P \leq 0.05$. Treatment was significant for both wings and tenders ($P<0.0001$). PL reduced *Salmonella*, EB, and APC by 0.71, 0.66, and 0.62, respectively, on wings, and 0.36, 0.32, and 0.25, respectively, on tenders compared to the control. When water with PL was compared to water alone, *Salmonella*, EB, and APC decreased by 0.64, 0.64, and 0.74 on wings. Only APC was reduced, by 0.29, on tenders when water with PL was compared to water alone. When PAA with PL was compared to PAA, *Salmonella*, EB, and APC decreased by 0.55, 0.30, and 0.35 on wings and 0.75, 0.40, and 0.44 on tenders. Finally, when 3 parts were simultaneously treated with PL, *Salmonella*, EB, and APC were reduced by 0.65, 0.63, and 0.57 on wings, and 0.54, 0.55, and 0.40 on tenders compared to untreated control. Similarly, when 5 parts were treated with PL, *Salmonella*, EB, and APC were reduced by 0.62, 0.64, and 0.64 on wings, and 0.53, 0.53, and 0.43 on tenders. These results demonstrate that the use of PL consistently reduced the levels of *Salmonella* EB, and APC.

Title: Functional analysis of DNA Ligase 1 gene polymorphisms in human cancers

Primary Author: Abigail Weir

Additional Authors: Amit Mitra;Salsabil Ahmed;Suman Mazumder;Ray Waliagha;Katie Marlow;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: DNA Ligase I, encoded by the gene LIG1, is an enzyme that is involved in chromosomal DNA replication where it is involved in ligating the lagging strand following discontinuous synthesis of Okazaki fragments, DNA recombination, and DNA repair pathways. Single nucleotide polymorphisms (SNPs) in DNA repair genes such as LIG1 can impair the function of the DNA repair pathway and lead to susceptibility to various cancers, as well as variable response to chemotherapy drugs. India is the most populous country on the Earth and has diverse subpopulations comprising a variety of ethnic groups, major religions, major language families, and morphological subgroups. This diversity led us to perform an in-depth India-specific investigation of functional SNPs within DNA repair genes like LIG1. The functional effect of SNPs found in LIG1 was predicted and was used to determine the most likely damaging SNPs in LIG1. Next, our objective is to study the differences in expression of LIG1 and to evaluate the variable drug response due to the presence of functionally relevant SNPs. For this purpose, human cancer cell lines were used for Sanger DNA sequencing and multiple sequence alignment to verify the presence of SNPs in drug-sensitive and drug-resistant cancers. Several cell-based functional assays were performed that compared the differences in drug response due to the presence of most important SNPs compared to the cancer cell lines with wild-type genotypes. Finally, we will investigate the role that the functionally relevant SNPs have on the DNA repair system. Where the relevant SNPs are not detected, it will be introduced into the wild type cell lines through site-directed mutagenesis. Successful completion of the project will provide us with functionally important LIG1 SNPs associated with DNA repair defects and eventual resistance to anti-cancer drugs. Ultimately, this will help precision medicine approaches in DNA repair-deficiency-associated cancers.

Title: Exposure to orthotics and prosthetics in undergraduate Kinesiology students in the Southeastern United States

Primary Author: Adan Vazquez

Additional Authors:

Department/Program: School of Kinesiology

College: College of Education

Abstract: Undergraduate kinesiology programs are frequently advertised as a gateway to a wide variety of healthcare professions, like physical therapy (PT). Despite requiring extensive knowledge of kinesiological principles, a career in orthotics and prosthetics (O&P) rarely makes these lists. Trends in public health, such as increases in life expectancy and related age-related comorbidities, and the prevalence of diabetes, have led to increased demand for O&P services, and is expected to continue. Therefore, it is imperative that more people are recruited to the field of O&P to keep up with this demand. The national pool of kinesiology students is a high-yield source of students to help fill this demand that may not be being fully tapped due to lack of O&P exposure. This study utilized an original, 28-item survey aimed at assessing awareness of and interest in O&P in undergraduate kinesiology students. The questions were intended to gauge participant's knowledge of O&P compared to PT and interest before and after watching promotional videos for O&P. 143 undergraduate kinesiology students (27 male; 116 female) from 6 universities in the southeast US participated in this study. Participation was limited to those 19+ years (mean age 20.1 ± 1.1). All participants provided informed consent prior to completing the survey. Median time to complete was 9.3 minutes, including two short videos from WhatIsPOP.org. The findings suggest that some participants either were aware of O&P but it was not their first thought or were not aware of O&P as a career. Regardless, there is potential for increased education of O&P among undergraduate kinesiology students. Participants were also found to have increased interest (+1.55) in exploring O&P after the promotional videos. These findings together also suggest undergraduate kinesiology programs may provide a reliable source of individuals for O&P and, therefore, should be targeted by outreach and recruitment efforts.

Title: The impact of oxidative stress on the volatile organic compounds in adipocytes

Primary Author: Adebowale Samuel OYERINDE

Additional Authors: Geetha Thangiah;Ramesh Jeganathan;Melissa Boersma;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Obesity is gaining more attention as a major health issue that reduces life quality because of its diverse complications. Recent findings suggest that oxidative stress plays a crucial role in linking obesity to its associated health issues. Several approaches have been developed to gain deeper insights into the extent of oxidative stress (OS) damage caused by various cellular OS products. Recently, novel diagnostic tools called volatile organic compounds (VOCs) have emerged as potential biomarkers for these conditions. A clearer understanding of how OS and the release of VOCs from differentiated adipose tissue interact would significantly assist in determining the exact sources or pathways of VOCs in different pathological conditions. In this research, we developed an OS model using hydrogen peroxide treatment on differentiated 3T3-L1 cells. We conducted a comprehensive analysis of the effect of OS on cell metabolism by examining VOCs present in the cell headspace. This analysis utilized solid-phase microextraction (SPME) combined with gas chromatography-mass spectrometry (GCMS). 8 VOCs were increased, while 4 VOC peaks showed a significant increase in oxidative stress-induced adipocytes. The VOC biomarkers were mainly linear and branched chain alkanes, straight chain, and aromatic alcohol probably derived from lipid peroxidation and amino acid metabolism when OS is induced in adipocytes. This study revealed volatiles that were influenced by OS, and provided clues for mechanism exploration of exhaled biomarkers, thus promoting the non-invasive prediction of obesity.

Title: Using unoccupied aerial systems to study the effects of biochar on wildflower planting health

Primary Author: Adeline Flach

Additional Authors: Geoffrey Williams;Anthony Abbate;Stephanie Rogers;Zachary Beneduci;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Pollinators are essential in natural and managed ecosystems. However, the loss of floral resources, primarily due to land use changes, has contributed to widespread pollinator decline. The positive effects of biochar, a carbon-based soil amendment, on the growth of agricultural crops suggest it may benefit the growth and health of pollinator-friendly wildflowers. However, this has been sparingly tested in field settings. Thus, the goal of this study was to investigate if there was a difference in the Normalized Difference Vegetation Index (NDVI) – a proxy for plant health – between biochar-amended and unamended plots. To distinguish plot variability, a DJI Mavic 3 Multispectral unoccupied aerial system (UAS), flown at 12 m altitude, was used to collect very high-resolution aerial and multispectral imagery (0.55 cm/pixel) at three sites across Auburn, AL. Data were collected five times at each site between May to October 2023. Each site was ~10,000 ft2 in size and subdivided into eight subplots: four experimental (containing biochar) and four control (not containing biochar). UAS imagery was processed using Pix4Dmapper and resulting raster bands were used to generate NDVI values for each subplot in ArcGIS Pro. Additionally, the *Zonal Statistics as Table* tool was used to calculate the mean, minimum, maximum, and standard deviation of NDVI values by subplot. Those variables were then compared between experimental and control subplots using general linear mixed effect models from the package 'lme4' in the R statistical computing environment. The results showed that there was no statistically significant difference between control and experimental plots [mean NDVI score difference of 0.009 (/- 0.021 C.I., p=0.37)], indicating no effect of biochar on NDVI values within the experimental time period. Future work will investigate potential time-lag effects.

Title: Prenatal cannabinoid exposure: emerging evidence of medial prefrontal cortex abnormalities

Primary Author: Adrian Courville

Additional Authors: Miranda Reed;Vishnu Suppiramaniam;Kawsar Chowdhury;Tia Daniels;Emma Redmon;Miles Wiley;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Cannabis is currently one of the most often used illicit drugs by pregnant women, with a 62% increase in usage from 2002 to 2014. Additionally, while there is a growing belief that using cannabis while pregnant is safe, the preclinical research examining these underlying neurocognitive changes is limited. This is especially concerning because clinical studies have shown that cannabis exposure throughout development causes long-lasting changes in neuro-functioning and cognition. An area of concern for these changes lies in the medial prefrontal cortex (mPFC) due to its ability to facilitate decision-making and memory connections. We hypothesize that prenatal cannabinoid exposure (PCE) alters glutamatergic signaling in the mPFC, leading to alterations in the hippocampus-mPFC pathway and ultimately to alterations in mPFC-mediated behavior. To address this, we examined offspring exposed prenatally to THC using the spontaneous alternation Y-maze task. We also analyzed glutamate receptor levels and signaling in the mPFC using immunoblotting. Results from this project will further our understanding of PCE mechanisms that result in neurocognitive alterations, specifically as they relate to the mPFC, and will add to the growing literature on some of the overall dangers that should be considered with cannabis use during pregnancy.

Title: Association between initial propranolol dose and blood pressure control in 48 to 72 hours among preterm infants with hypertension

Primary Author: Ahmed Mostafa Ahmed Kamel

Additional Authors: Matthew Loop;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Preterm infant hypertension is treated with propranolol, but the optimal initial dose is unclear. We assessed differences in mean arterial pressure 48-72 hours after initiation of propranolol among different initial doses. We performed a retrospective cohort study of inpatient preterm infants who received antihypertensive therapy. We obtained the dataset via electronic medical records from the University of Alabama at Birmingham. We identified new users of propranolol with doses of 0.25, 0.5, and 1 mg/kg. We excluded prevalent users of any other antihypertensive drug and infants diagnosed with hemangioma before initiating propranolol. Our primary outcome was mean arterial pressure 48-72 hours after initiating propranolol. We used a Bayesian linear regression model for this outcome, adjusting for baseline mean arterial pressure and gestational age at birth. We considered a mean difference of 1 mmHg in the primary outcome as a clinically relevant difference among the three initial doses. Our cohort included 45 patients (16 patients initiated 1 mg/kg, 17 patients initiated 0.5 mg/kg, and 12 patients initiated 0.25 mg/kg). The adjusted mean difference between 1 mg/kg and 0.5 mg/kg was -1.1 mmHg (90% credible intervals: -3.7 mmHg, 1.5 mmHg). The probability that the 1 mg/kg dose had a clinically meaningful benefit compared to the 0.5 mg/kg dose was 3.8%. The adjusted mean difference between 1mg/kg and 0.25 mg/kg was 1.2 mmHg (90% credible intervals: -1.6 mmHg, 4.0 mmHg). The probability of the 1 mg/kg being more beneficial than the 0.25 mg/kg was 0.3%. Our results suggest that for preterm infants being treated for hypertension, a higher propranolol dose of 1 mg/kg versus a lower dose of 0.5mg/kg or 0.25 mg/kg is unlikely to be associated with meaningfully better mean arterial pressure control within 48 to 72.

Title: The impact of vacuum packaging on vlavor in chicken breasts over time

Primary Author: Ainsley Jessup

Additional Authors: Sungeun Cho;Michelle Hayden;Linda Barahona Dominguez;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The Alpha Mos electronic tongue (a-Astree II, E-Tongue) and electronic nose (Heracles Neo, E-Nose) have been widely applied in taste and smell evaluation. In this study, we used these instruments to identify flavor differences between vacuum and tray packaging in chicken breasts during 6 days of storage at approximately 4 degree C. The half of breast meat were vacuum packaged (Ossid RT30), and the other half were tray packaged (Ossid E10). For E-Tongue analysis, 20 grams of the upper third of the breast were homogenized with deionized water, filtered, centrifuged, and filtered again through a 0.45 micrometer filter. Approximately 35 mL of the filtered liquid sample was analyzed in triplicate. For E-Nose analysis, 2 g of chicken breast samples in triplicate were measured, placed into a 20-mL vile, and sealed for analysis. On day 3, the tray-packaged chicken breast formed hydroperoxides (e.g., p-menthadienhydroperoxide), indicating lipid oxidation. No hydroperoxides were found in the vacuum-packaged meat on all days, but some volatiles derived from lipid oxidation (e.g., acetaldehyde and propanal) were formed on day 5. The E-tongue did not show taste difference between packaging. This study suggested vacuum packaging can slow the lipid oxidation process during the chicken breast storage, keeping a better aroma quality.

Title: A multi-temporal analysis of NASA's Ice, Cloud and land Elevation Satellite-2 data for assessing hurricane-driven forest disturbances.

Primary Author: Ajay Gautam

Additional Authors: Lana L. Narine

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Disturbance events such as hurricanes can drastically alter the structure and composition of forests. Hurricane Sally, (Category-2 on Saffir-Simpson), made landfall on September 16, 2020, in Gulf Shores, Alabama, and the Florida Panhandle, causing significant damage to forested areas. An estimated $1.56 million in timber was lost, with approximately 2440 acres of forest lost within Mobile and Baldwin coastal counties. The high intensity and frequency of hurricanes pose a risk of permanent damage to forest stands, including structural damage, increased susceptibility to fires and diseases, and loss of seeds for regeneration. Assessing the extent of hurricane damage is crucial for recovery efforts and for developing strategies to adapt to future disturbances. National Aeronautics and Space Administration's(NASA's) launched Ice, Cloud, and land Elevation Satellite-2 (ICESat2) provides global earth elevation data collected by its Advanced Topographic Laser Altimeter System(ATLAS) since September 2018. The availability of three-dimensional (3D) information from ICESat-2 offers an opportunity to examine forest structure over broad spatial and temporal scales. Specifically, this study investigates ICESat-2's, land, and vegetation products or ATL08 along repeated Reference Ground Tracks(RGTs). Canopy change metrics are compared pre and post-disturbance to evaluate changes in forest structure and cover and accuracy assessments are conducted using reference airborne lidar data. This work is anticipated to advance our understanding of the utility of ICESat-2 to address forest changes driven by disturbance.

Title: Understanding endozoochorous seed dispersal potential of dominant Southern weeds

Primary Author: Akashdeep Singh

Additional Authors: Brandon Smith;David Russell;Aniruddha Maity;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Cattle grazing on weed-mixed forage biomass can potentially spread weed seeds, leading to plant invasions across pasture lands. Understanding the possibility and intensity of this spread is crucial for developing effective weed control methods in grazed areas. This research examined the influence of bovine digestive fluid on the survival and germination of six different weed species. We conducted an in vitro experiment to evaluate the germination and survival of weed seeds after incubation in bovine digestive fluid for seven time periods (0, 4, 8, 12, 24, 48, and 72 hours). Furthermore, a full Tilley and Terry procedure was applied to an eighth sample after 48 hours of incubation by stopping fermentation, simulating complete abomasum digestion. The findings revealed differences in seed survival and germination among all weed species, with tall morningglory reaching zero germination after 24 hours of incubation but palmer amaranth and johnsongrass still having upto 10% germination after 96 hours of incubation, suggesting that cattle grazing could affect seed distribution and invasiveness in grazed grasslands and rangelands. The small seed size, hard and impermeable seed coat of Palmer amaranth and Johnsongrass made them highly resistant. In contrast, morningglory seeds were highly susceptible to rumen fluid, likely due to their seed coat becoming easily permeable and ruptured. This suggests that cattle grazing could be a significant seed dispersal mechanism for some weed species. Our research provides important insights into the potential role of grazing as a weed dispersal mechanism or a practical, cost-effective method for weed control by decreasing germination and viability in some weed species.

Title: Respiratory bioaerosol dynamics: impact on evaporation and hygroscopic growth

Primary Author: Akhil Teja Kambhampati

Additional Authors: Mark Hoffman;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: In the realm of infectious disease research, airborne viral transmission stands as a paramount concern due to its pivotal role in propagating pathogens within densely populated regions. However, amidst this landscape, the phenomenon of hygroscopic growth within respiratory bioaerosols remains relatively underexplored. This study addresses this gap by focusing on the behaviors of a single respiratory bioaerosol, which consists of saliva, pathogen particles, and water. Unlike pure water aerosols, the unique composition of respiratory bioaerosols leads to varied evaporation rates and hygroscopic growth patterns, influenced by factors such as ambient humidity, temperature, and airflow. Through integration into mass, momentum, and energy equations, the study unveils the intricate interplay between evaporation and hygroscopic growth over time. Employing numerical modeling enables the temporal analysis of bioaerosol characteristics, including size, temperature, and trajectory, providing insights crucial for understanding infectious disease spread. This research holds significant implications, particularly in high-risk environments like healthcare facilities and public transportation systems, where even a single respiratory bioaerosol can profoundly impact viral transmission dynamics. Ultimately, by elucidating the nuanced behaviors of respiratory bioaerosols, this study aims to target the development of more effective preventive strategies against airborne pathogens, thereby contributing to public health efforts on a global scale.

Title: Observing cyanobacteria and algae coculture in wastewaters for fish feed and water reclamation

Primary Author: Al Dean Francisco

Additional Authors: Qichen Wang

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Aquaponics combines fish farming and crop production in one system, which improves sustainability in both fish cultivation and vegetable production. Though aquaculture plants reduce nitrogen and phosphorus in fish waste and help clean the water, waste remnants persist. A solution that Dr. Higgin's lab at the Center for Advanced Science, Innovation, and Commerce of Auburn University has offered is to utilize algae to help reduce excess waste nutrients in the water. Furthermore, these algae will become fish feed for the aquaponics system, causing the current system to improve its sustainability and reduce unnecessary maintenance. However, one problem arising from this idea is the potential growth of cyanobacteria, a blue-green algae, which could release cyanotoxins. Fish may ingest these cyanotoxins, which would later become dangerous for those who consume them. Previous work has observed the presence of cyanobacteria in municipal wastewater. This research paper will add to these ongoing findings by: testing if cyanobacteria are inhibited in strong wastewater like anaerobic digestate with active inoculation; testing a coculture of green algae and cyanobacteria and observing their growth and interactions; and testing how much cyanotoxin can be released by cyanobacteria in anaerobic digestate. The results from these tests can be steadily observed and applied to aquaponics fish waste. Early research shows that waste nutrients in municipal anaerobic digestate can stop cyanobacteria from growing. Other research suggests that green algae can grow faster than cyanobacteria in a strong wastewater coculture.

Title: Maximizing therapeutic potential: tailoring a PD-1-dependent 4-1BB agonist for combination immunotherapy

Primary Author: Alana Kramer

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

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Malignant cancer cells employ diverse strategies to evade the immune system within the tumor microenvironment (TME) and facilitate tumor growth. While immune checkpoint inhibitor (ICI) therapies counteract some of these immunosuppressive mechanisms, limitations appear in patients with single-agent therapy. The integration of ICIs with co-stimulatory receptors has emerged as a strategy to enhance patients' immune responses. One notable receptor is 4-1BB (CD137), which activates CD8 T cells, induces IFN-γ secretion, and triggers a potent anti-tumor immune response. Unfortunately, the 4-1BB agonist monoclonal antibody, Urelumab, induced severe hepatotoxicity in human cancer patients. This is associated with the systemic activation of 4-1BB receptors on monocytes, which recruit CD8 T cells causing widespread hepatocellular damage. We hypothesize that restricting 4-1BB activation to the TME will mitigate hepatotoxicity while triggering a robust antitumor immune response. To achieve this goal, we designed three distinct murine-specific formats of aPD-1-4-1BBL fusion proteins. These proteins utilize an anti-PD-1 nanobody to cross-link and trimerize the 4-1BB receptor. Since PD1-expressing T cells are most abundant in the TME, this approach will prevent the systemic activation of 4-1BB receptors, limiting hepatotoxicity, and simultaneously triggering a potent anti-tumor immune response within the tumor. The three formats were synthesized, and SDS-PAGE and western blot analyses confirmed the expression of the formats in conditioned media. Stable cell lines expressing murine 4-1BB or PD-1 confirmed the binding ability of formats to these receptors by flow cytometry. In future studies, we aim to investigate protein activation of murine 4-1BB in the presence or absence of PD1-expressing cells in an in vitro bioassay. Subsequently, we will explore the therapeutic efficacy and toxicity profiles of various mu-aPD1-4-1BBL proteins in mouse melanoma tumor xenograft models.

Title: Effects of antibiotic growth promoters on intestinal morphology and digestive enzyme activity in weaner pigs

Primary Author: Alex Outlaw

Additional Authors: Derreck Ivey;Julia Bartosh;Marko Rudar;Haejin Kim;Lexi Gachman;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Weaning is a multifactorial stressor in pigs caused by abrupt changes in diet, social structure, and environment. At weaning, pigs transition from a highly digestible milk to a less digestible solid nursery diet. This shift disrupts gut structure and digestive enzyme activity that negatively affects growth performance. However, antibiotic growth promoters mitigate the impact of weaning stress on gut health and growth performance, potentially by modifying digestive capacity. The objective of this study was to determine if antibiotic growth promoters affect digestive enzyme activity and intestinal morphology in weaner pigs. At 28 d age, pigs were weaned and assigned to one of two treatment diets: no additive (negative control; n = 8 pens) or antibiotic growth promoter (AGP; Carbadox, 50 ppm; n = 8 pens). Diets were fed for 21 d; six mixed-sex pigs were housed per pen. One pig per pen was euthanized on d 7 and d 21 for sampling. Jejunum and ileum tissue and mucosa samples were collected for enzyme activity analysis; an adjacent section of tissue was collected and stored in neutral-buffered formalin for morphology analysis. Enzyme activity units (U) were determined nmol of substrate hydrolyzed per mg of protein per minute (U = nmol/mg protein/min). Maltase activity was not different between treatments (43.6 /- 15.5 vs 38.0 /- 13.4 U, $P > 0.10$) . Maltase activity was higher on d 21 than d 7 (40.8 /- 14.4 vs. 64.0 /- 22.6 U, $P < 0.01$). Villus height (VH), crypt depth (CD), and VH:CD ratio was not different among treatments in either jejunum or ileum ($P > 0.10$). VH in the ileum ($P < 0.001$), CD for jejunum and ileum ($P < 0.01$), and a tendency for VH:CD ratio in the ileum ($P = 0.07$) were higher on d 21 than d 7. These results suggest that the observed benefits in growth performance from AGP supplementation are not due to its effects on maltase activity and gut architecture. Sucrase and lactase activity will be determined in future analysis.

Title: Examining the relationship between chronotype, social behaviors in the workplace, and extroversion

Primary Author: Alexander Barton

Additional Authors: Sara Driskell;Lucero Montero;Aly Grace Kessler;Annika West;Camryn Bassler;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Sleep is a necessity, no matter who you are, how old you are, or what you do. Everyone needs to make sleep a part of their daily routine. There are many ways sleep affects people's lives. For example, lots of research has tied sleep behaviors to cognitive performance. However, its effects on social behaviors and processes are understudied. We collected data from 145 American adults through a self-report survey on MTurk. Our correlational study examined one aspect of people's sleep cycles, their chronotype (how much of a morning person to night owl someone is), and related it to their work behaviors, specifically their social behaviors in the workplace and motivations for these social behaviors, as well as their levels of extroversion. We found that people who are more morning oriented are more extraverted than their evening counterparts. We also found that people whose jobs matched their chronotype reported enjoyed interacting with others more at all levels (from junior workers to supervisors). They also reported more intentional building of social capital and improving their social network and liking teamwork more. Participants with more sleep satisfaction reported liking their job more, more intentions to build their social networks, and liking teamwork more. These participants also reported spending more of their recreation time outside of work on social interactions and enjoying that time more. This suggests that improving sleep and matching the hours a person works with their morning-evening preference may lead to improved outcomes for employees. There are multiple factors that have shown an association with sleep. This research begins to inform the important work of understanding how our sleep behaviors impact our social lives in the workplace, which could further inform future research on strategies for building social connections and social capital for workplace success.

Title: Effect of high velocity/hyperoxic breathing therapy on blood lactate kinetics after a Wingate test

Primary Author: Alexander Berry

Additional Authors: Bruce Gladden;Michael Roberts;Serhat Yildiz;Nina Stute;Max Michel;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Sprint-type exercise elevates blood lactate concentration ([La-]b), causing acidosis and fatigue. Post-exercise, [La-]b peaks, gradually returning to baseline over an hour. High velocity breathing therapy (HVT) delivers O2, purportedly enhancing CO2 elimination and ventilatory efficiency, potentially hastening [La-]b decline, speeding recovery. This study investigated HVT's impact on [La-]b kinetics after intense exercise (Wingate test). 15 participants (8M; 7F; 26 *plus or minus*2y) completed a 30s Wingate test, followed by 60min of recovery under 4 randomized HVT conditions: 21% O2 at 5L/min, 21% O2 at 35L/min, 100% O2 at 5L/min, and 100% O2 at 35L/min. Cycle ergometer resistance was 0.085 kp/kg body mass. Assessments included Perceived Recovery Status, Rating-of-Fatigue, physiological measurements, Wingate performance metrics, and [La-]b. Blood samples collected pre-exercise and during recovery analyzed [La-]b. Recovery [La-]b values were fit to a bioexponential equation to identify time constants for [La-]b increase (tau1) and decrease (tau2), peak [La-]b and time to peak [La-]b. Recovery status and performance metrics (peak power, final power, fatigue index) were consistent across tests (p=0.2759, p=0.3896, p=0.2801, p=0.2046). Fatigue rating improved during recovery with no difference among conditions (p=0.6773). Peak [La-]b declined numerically but not significantly (p=0.2211) across conditions from 21% O2 at 5L/min to 21% O2 at 35L/min to 100% O2 at 5L/min, and 100% O2 at 35L/min. No significant difference existed between conditions for time to peak [La-]b (p=0.1125), tau1 (p=0.7407), or tau2 (p=0.5701). A trend towards a smaller [La-]b area under the curve for 100% O2 at 35L/min during recovery was observed (p=0.0530). A potential small effect of high velocity airflow with hyperoxia on venous [La-]b kinetics during recovery from maximal effort exercise was suggested by a smaller area under the curve for venous [La-]b in the 35L/100% condition.

Title: Investigating a streamlined altium PCB design to thermal analysis workflow for low temperature computing architecture optimization

Primary Author: Alexander Rush

Additional Authors: Michael Hamilton;Chase Tillman;Sherman Peek;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: The design of printed circuit boards (PCBs) is important for integrating integrated circuits (ICs) and electronic packages into larger electronic systems. Typical design criteria when designing PCBs involve area consumption, power consumption, and thermal loads. Though area and power consumption are critical, unexpected thermal performance often leads to partial, if not complete, system failures. Whether unexpected thermal performance is caused by environmental factors (e.g., space or national defense applications) or caused by on-board heating from active circuitry, insights into thermal performance are key to avoiding critical failure cases and achieving expected performance metrics. With quantum/superconductive computer architectures becoming computationally viable at scale, an area of concern is improper PCB thermalization/heating effecting superconductive material properties at cryogenic temperatures. The more widely used applications aimed at tackling this issue are useful but often have the PCB designer redesigning major portions of the initial board design before beginning thermal simulations. We address this workflow issue using alternative software, Thermal Risk Management (TRM) from ADAM Research. TRM offers a direct path from multiple PCB design applications into TRM and immediately into thermal simulations with high fidelity in both control over environmental scenarios and load(s) placed upon the PCB components and/or traces. We investigate the viability of this workflow for the use in thermal optimizations for cryogenic applications. Optimizing the process flow and understanding design choices that effect the thermalization of PCBs at cryogenic temperatures will help improve the quality of boards produced along with saving production costs for designers.

Title: The temporal development of behavior in broiler chicks throughout the seven days of life

Primary Author: Alexandra Jackson

Additional Authors: Bethany Baker;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: In their first week chicks undergo many significant physical and behavioral developmental changes. Currently little is known about how normal behaviors in chicks develop over time in a production setting. Understanding this will help ensure that chicks' behavioral needs are met thereby improving bird welfare. This study aimed to define how chick behavior develops in the first week of life. Behavior assessment was performed on three focal chicks (25 birds/pen) using continuous focal sampling from day (D) 1 to 7. The behaviors of standing, sitting, walking, running, eating, drinking, preening, comfort, play, explorative, sleeping, and allogrooming, were assessed as a percentage of time performed per day. One-way ANOVA with day as main effect was performed (Proc Mixed, SAS 9.4), means were separated by Tukey-Kramers. A difference was found in all behaviors between D 1-7 apart from standing. Sitting increased with age, as chicks performed less sitting on D1, 2, and 3 than on D5 and D7. Walking ($P<0.01$) and running ($P<0.01$) were lowest on D2, increasing until D6 for walking and D7 for running. The proportion of time spent eating ($P<0.01$) and drinking ($P<0.01$) was lowest on D1, steadily increasing over the week. Preening ($P=0.02$) increased with age, being observed less on D1, 2, and 3 than on D4, 5, 6 and 7. Comfort ($P<0.01$) behaviors increased over the week occurring least on D1 and most on D5 and 6. Play ($P<0.01$) behavior started on day 2 and increased with age, with the most play behavior performed on D7. Explorative behavior was lowest on D1, it then increased on D2 after which it plateaued. Sleeping and allopreening decreased with age, occurring most on D1 and less by D7. Overall, chicks decreased in percentage of time performing sleeping and allopreening and increased in all other behaviors, other than standing, from D 1-7. These results show that as chicks age they start to perform more active, nutritive, and comfort behaviors.

Title: Localizing the movement (NSm) protein of tomato spotted wilt virus in nicotiana benthamiana

Primary Author: Alexandra Rios

Additional Authors: Abdelaal Hamaam Abdelaal Shehata;Kathleen Martin;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: *Tomato spotted wilt virus* (TSWV), genus *Orthotospovirus*, is an ambisense ssRNA virus. TSWV is listed as one of the most economically devastating viruses infecting over 1000 plant hosts. Although field resistance in peanuts was established in 2006, in 2021, an increase in symptoms was observed. TSWV contains five open reading frames (ORF), a nucleocapsid, N, NSm, putative movement protein, NSs, silencing suppressor, Gn and Gc, glycoproteins and L, an RNA-dependent, RNA polymerase. The interest of this study was to study natural variations in the NSm ORF and identify how these mutations impacted the protein localizations in *Nicotiana benthamiana*, a host for this virus. Initial analysis of six NSm sequences, isolated from three field locations in Alabama, revealed there are no conserved mutations. It was hypothesized that localization patterns would be unchanged between our isolates and a well-characterized strain, TSWV-MT2. We fused the ORF of the six proteins to the green fluorescent protein (GFP), transformed them into *Agrobacterium tumefaciens* for infiltration, and expressed in plant tissues. Compared to previous results that suggested NSm changed its localization pattern from the cell periphery to more centralized regions from two to three days, the mutated NSms moved in the cell more rapidly. While further investigation is required, these findings may indicate that changes in NSm are playing a role in the increased infection rates of the virus.

Title: Heavy metal peaks provide chronological control in modern post-bomb bat guano deposits

Primary Author: Alexandra Tsalickis

Additional Authors: Richard Vachula;Matt Waters;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Bat guano has gained recognition as a reliable paleoenvironmental archive in recent decades, but to reconstruct paleoenvironmental conditions using bat guano, an age-depth model is required. While radiocarbon dating is the most acceptable method for determining chronologies, it is not possible to use it on modern-aged (i.e., post-1950 CE) bat guano; therefore, a reliable method for dating post-bomb and post-industrial guano deposits is needed. Heavy metals are an untested means of dating post-bomb guano deposits. Here, we use peaks of heavy metal concentrations of lead (Pb), molybdenum (Mo), and chromium (Cr) to identify singular dates within a bat guano core collected from Cripps Mill Cave in Tennessee, USA. One peak in Pb concentration is interpreted to indicate 1974 CE, synchronous with peak-leaded gasoline combustion in the United States. Three peaks in Mo concentrations in the Cripps Mill guano core correspond to Mo concentration peaks in ice cores and date to 1975, 1980, and 1989 CE, respectively. These peaks reflect increased Mo concentrations sourced from anthropogenic coal and oil combustion. Utilizing the interpreted dates, we created an age-depth model for the Cripps Mill guano core. Further, we show and discuss the utility of our approach in two additional guano cores from the southeastern US. Our approach shows that heavy metal peaks are an effective method for dating modern post-bomb guano deposits, opening new opportunities for linking guano-based paleoenvironmental research with modern, post-bomb observations.

Title: The impact of trauma on the menstrual cycle

Primary Author: Alexis Winsor

Additional Authors:

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

College: College of Education

Abstract: This literature review focuses on the rapid cyclical increase and decrease of sex hormones across the menstrual cycle that impact psychiatric disorders. Individuals who have a history of adverse childhood experiences are at risk for menstruation and fertility issues. Women who report abuse and traumatic experiences before the age of 12 are more likely to experience amenorrhea. Menstrual cycle disruption and fertility difficulties can be linked to childhood stressors. Women's menstrual health is a telling sign of the emotional and psychological safety they experience. 14-25% of women have irregular cycles. Atypical menstrual symptoms give insight into the experience of clients and how trauma is having a physical impact on the body. Counselors need to be mindful to ask about the regularity, abnormalities, or concerns regarding the client's menstrual cycle. The correlation between the client’s emotional and physical health should be explored in the session. Seek ways to regulate the central nervous system so the body feels safe again to regulate the menstrual cycle.

Title: Toxicokinetics of environmentally realistic micro(nano)plastics towards *Daphnia magna*

Primary Author: Alison Boardwine

Additional Authors: Tham Hoang;Andrew Barrick;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Micro(nano)plastics pose significant environmental risks, specifically for aquatic organisms. There is a lack of research on how environmentally realistic plastics at the micro- (<5mm) and nanoscale (<1um) impact aquatic organisms. The presence of biomagnification introduces an additional risk where micro(nano)plastics accumulate along the food chain of aquatic ecosystems. Plastics collected in the natural environment present testing complications resulting in a lack of repeatability, so primary plastics are often used in plastic research. This knowledge gap highlights the need for additional research into the adverse effects of environmentally realistic micro(nano)plastics on aquatic organisms, given their prevalence in their natural habitat. The purpose of this study was to characterize toxicokinetics and hazard potential for environmentally realistic micro(nano)plastics on <<Daphnia magna>>. Plastic cups and forks were micronized to <120um and five concentrations ranging from 0.01 mg/L to 100 mg/L were prepared in moderately hard water. *Daphnia magna* were exposed to these five concentrations for 48 hours and mortality and bioaccumulation were documented. The dose-response profiles were inconsistent with the increase in concentration because the micro(nano)plastics did not establish a homogenous test suspension. The highest concentration of 100 mg/L was then used to test uptake and depuration presence in the individual organisms where accumulation was confirmed to be increasing up to 48 hours. Both types of plastic particles were confirmed to be polystyrene and similar in size ratios using Raman spectroscopy. Bioaccumulation was demonstrated in both types of plastics and did not result in acutely toxic effects while uptake and retention presence were different in each type of plastic. This suggests that further research is needed to look at how environmentally realistic micro(nano)plastic characteristics like chemical additives and sizes influence their bioaccumulation and hazard potential on aquatic organisms.

Title: Enhancing contractile function of engineered cardiac tissues through enriched fatty acid media cultivation

Primary Author: Alison Brown

Additional Authors: Rajesh Amin;Elizabeth Lipke;Mohammadjafar Hashemi;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cardiovascular disease, a global leading cause of death, demands advanced contractile tissue models for accurate disease modeling, drug studies, and pre-clinical tests. A specific focus is on diabetic cardiomyopathy (DCM), a condition causing structural and functional abnormalities in diabetic hearts. Human-induced pluripotent stem cell derived cardiomyocytes (hiPSC-CMs) present great potential for disease modeling. Previous studies on two-dimensional (2D) substrates showed immaturity issues in hiPSC-CMs. Three-dimensional (3D) tissues offer more accurate models by recapitulating native tissue complexity.   Our prior work demonstrated hiPSCs in PEG-fibrinogen (PF) hydrogels achieve cardiac differentiation and some maturation aspects. Here, we created engineered cardiac tissues (ECTs) by encapsulating hiPSCs in rectangular PF hydrogels followed by in situ cardiac differentiating. We cultured them in fully defined fatty-acid-enriches metabolic maturation (MM) media, promoting the use of fatty acid oxidation as the primary energy source. To study the impact of MM media on the contractile functionality and structural maturation of hiPSC-CMs, we compared them to age-matched RPMI/B27 with insulin (RP)-cultured samples (regular media for culturing ECTs). ECTs in MM exhibited higher contraction frequency (1.4-fold), contraction and relaxation velocities (2.9 and 3.2-fold), and directionality (1.95-fold), along with significantly greater maximal fractional shortening (7.3-fold) on day 16 compared to RP (n greater than or equal to 3 individual batches with at least two tissues per batch). These data collectively suggest a significant improvement in contractile functionality in the ECTs cultured in MM.   In conclusion, our study indicated that one week of ECT culture in enriched fatty acid media promoted the contractile functionality of hiPSC-CMs in ECTs. This strategy provides more appropriate mature model for studying cardiac disease, especially for metabolic diseases like DCM.

Title: Analyzing the use of chairs in modern media

Primary Author: Alissa Johnson

Additional Authors: Darby Huber;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Certain artifacts, symbols, philosophies, and other similar items and ideologies have persisted across the rise and fall of different cultures. However, one thing that has impacted humankind's history and a portion of its creation is the design of their residences, workplaces, and entertainment spaces. And none has affected these the deepest or the longest than interior furniture pieces' creation and changing structure. Upon closer analysis of the structures, materials, historical background, and suggested implementation in modern cinema, their significance and the meaning represent a feeling or a culture is revealed. This research aimed to explore furniture depictions in media and assess the selection intention through the lens of interior design history and auteur theory. Using this framework, inferences were made about the efficacy of the selection. This research takes the form of sequenced case studies, where each piece of media analyzed serves as a mini case study. Examples include analyzing furniture pieces such as The Barcelona Chair, Greco-Roman, and modernist chairs; using certain furniture types creates an implicit feeling in the viewer. Furniture carries an underlying meaning and significance that impacts humans and the design of spaces long after their initial introduction into the world. The way that furniture is perceived and used in a room is also indicative of the historical narrative that the furniture pieces carry, as well as the piece's origins. The significance of this research is to explore the importance of furniture in modern media and the role that it subtly plays in adding to the plot and characters. Through the analysis of these films, it is also clear that the individuals (auteurs) who selected these pieces of furniture were also aware of these facts and used the furniture pieces accordingly. From the historical narrative embedded in each piece, it evokes implicit feelings in each viewer that transcends beyond the media itself, but to something much more powerful.

Title: Quantifying energy consumption in outdoor power equipment: a physics-based framework for string trimmers

Primary Author: Allison Link

Additional Authors: Jacob Skupien;Jon Nell;Kati Kent;Paul Bartley;Mark Hoffman;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Decarbonization regulations have propelled a commercial transition from gas power to electrical power for Outdoor Power Equipment (OPE). This research aims to provide a robust, physics-based framework for quantifying OPE energy consumption, with a specific focus on string trimmers. Experiments conducted evaluated each tool under variable conditions to determine power consumption. The tests were conducted for various brands and models of string trimmers at multiple revolutions per minute ("RPM") settings. A constant 0.095-inch cutting diameter was used, and trimmer lengths were evaluated for 12, 15, 18, 21, and 24 inches. Longer line lengths are used for trimming larger spaces quickly, while shorter lengths are useful in smaller, tighter areas. Results revealed larger lengths increase power consumption, particularly at high RPMs. The study employed analytical methods to enhance the depth and reliability of the experimental data. Analyzing the trimmer head's motion yielded quantifiable outcomes of torque (rotational force), mechanical power (work rate), and energy consumption (total energy used during operation). By assessing the amount of resistance on the string as it spins, known as the drag force, torque and power were derived at each infinitesimal portion along the length of the string. Results indicate that torque and power increase with longer string lengths, aligning with the intuitive understanding that torque is proportional to drag force and lever arm, and power is the product of torque and rotational speed. With longer string lengths, the trimmer motor must generate more torque to overcome drag, thus, more power is required. This analysis confirms experimental findings that larger string lengths lead to increased power consumption. Future experiments on trimmers would include the actual energy usage from the battery pack, as manufacturer specifications which were used for derivation are not always accurate.

Title: Risk perception among scavengers: How does the introduction of a carcass into a wildlife landscape affect the presence and overlap of different species?

Primary Author: Ally Cobern

Additional Authors: Ansley Strength;Jean Fantle-Lepczyk;Christopher Lepczyk;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Scavengers play a key role in habitat health by breaking down the dead bodies of animals, or carrion, into usable nutrients that cycle back into the ecosystem. Vertebrate scavenging has been documented to impact food web dynamics, but the specific interactions between scavengers, predators, and prey that cause these impacts are less defined. To understand scavenger dynamics across a range of vertebrates, we set up motion-triggered cameras to monitor scavenger activity at manually-placed pig carcasses within the Wehle Tract of the Forever Wild Land Trust in Midway, Alabama. This nature center was selected because it is fenced and strategically managed to support a rich diversity of Alabama wildlife. Notably, this area is inhabited by invasive feral hogs, which both supplied carcasses for study and provided a unique perspective into scavenger interactions around invasive species carcasses. While we were able to place one carcass during our time at Wehle, issues with permitting restricted us from continuing our studies for the time being. However, from monitoring this carcass, we have amassed a collection of photos of scavengers that we will analyze to detect patterns in spatial and temporal overlap or avoidance of different species. We will be permitted to place more carcasses in late February, which will be monitored with game cameras at a variety of locations within the land trust. As we continue this research, we intend to quantify how inter- and intra-specific scavenger interactions are influenced by other factors including cover availability, species of carrion, and proximity to humans.

Title: Dual site administration of AAV gene therapy for treatment of feline GM1 gangliosidosis

Primary Author: Amanda Gross

Additional Authors: Douglas Martin;Juan Rodriguez;Courtney Garrett;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: GM1 gangliosidosis is a fatal neurodegenerative disease caused by a deficiency of lysosomal β-galactosidase (βgal). There are currently two ongoing clinical trials for the treatment of GM1 gangliosidosis using adeno-associated viral (AAV) gene therapy administered either intravenously (IV) or in the cerebrospinal fluid (CSF) via the cisterna magna (CM). Preclinical trials of either administration route show that single site treatment significantly increases lifespans in a feline model of GM1 gangliosidosis. We hypothesize that deficiency in efficacy caused by either single site injection will be addressed by the additive effect of combinatorial administration. GM1 cats received 6.0x1013 vector genomes/kg of AAV9 split equally between IV and CM administration at approximately 2 months of age. Four animals will be followed to humane endpoint and four animals will be evaluated 16 weeks following treatment. Untreated GM1 animals survive approximately 8.0 +/- 0.6 months while treated animals have a significant increase in average lifespan to 13.2 +/- 2.8 months, with 3 animals in the long term cohort still alive at 16.4, 14.2 and 8.8 months of age. Clinical assessments include neurological exams, CSF biomarkers, and 7T magnetic resonance imaging (MRI) and spectroscopy (MRS). Postmortem analysis included βgal and AAV distribution. Neurological abnormalities, which in untreated GM1 animals lead to an inability to stand and humane endpoint by 8 months of age, were attenuated in all treated animals. Aspartate aminotransferase (AST) and lactate dehydrogenase (LDH), biomarkers of central nervous system damage when measured in the CSF, were both reduced in in treated animals in comparison to untreated animals. While animals are ongoing we are unable to determine if CM IV administration of AAV is better than either single administration route however, the combined treatment did significantly improve length and quality of life in GM1 cats.

Title: How an endemic foliar pathogen evolve in a single growing season under ozone stress?

Primary Author: Amanpreet Kaur

Additional Authors:

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: In agricultural systems, the pivotal concern of resistance breakdown or erosion necessitates a priority focus on understanding the durability of disease resistance under future climatic conditions. Despite advancements, our comprehension of how climate change might impact host-pathogen interactions and the identification of effective disease management strategies remain inadequate. In this study, we assessed the efficacy of disease resistance against a leaf spot pathogen, *Xanthomonas perforans*, under elevated ozone in open-top chamber field settings, utilizing two pathogen genotypes to mimic co-occurrence of different pathogen genotypes in pepper fields. We observed compromised disease resistance in the resistant cultivar under elevated ozone, with high variability in pathogen populations. It could be attributed to alterations in host immune response, pathogen fitness, associated microbiome, or their combined effect. Our specific focus was on understanding the pathogen's response. While susceptible cultivars exhibited dominance of a single pathogen genotype across environments, resistant cultivars supported the co-occurrence of both genotypes, suggesting the maintenance of heterogeneity as an adaptive strategy, particularly evident during the end season under elevated ozone. Remarkably, a single season led to an increased mutation rate with the presence of de novo parallel mutations in the pathogen population in resistant cultivars under elevated ozone, indicating a need to focus on more breeding strategies against pathogens and altered environment conditions at the same time.

Title: Influencing human behavior in Japanese train stations through multisensorial design practices.

Primary Author: Amelia Conrad

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Shinkansen, the Japanese bullet train, is a form of public transportation for Japanese commuters and tourists, allowing rapid travel from city to city. With tourism rising in Japan, the need for efficient, well-designed train stations is increasing, providing an opportunity to study how interior design selections and spatial decisions can create an organized, easy-to-navigate environment for commuters. Utilizing multisensory design, an approach that coordinates visual, auditory, olfactory, and tactile experiences, evokes emotional responses that enhance human perception of the built environment to positively shape behavior such as ease of wayfinding and safe navigation through the space. Evaluating the multisensory interaction between train station design and human behavior reveals that lighting selections and acoustic considerations alter the way people navigate through space. Appropriate visual stimuli and spatial design create spaces that are both aesthetic and functional; overcrowding, a lack of navigational tools, and safety concerns for passengers are common concerns, and induce high levels of stress and anxiety. The purpose of this research is to design a prototypical train station for Shinkansen using a functional, multisensory design approach based on precedent analysis as well as current literature. This prototype will include innovative lighting choices that implement appropriate color temperatures and intensities, acoustic dampening systems to reduce mechanical noise, design for the unity of all senses, and detailed attention to successful Japanese precedents. The significance of this research is to fill the gap in the literature surrounding multisensory interactions in train stations to facilitate supportive, organized transportation for commuters.

Title: Evaluation of agricultural and clinical antifungal agents against members of the Fusarium solani species complex.

Primary Author: Amelia Flesner

Additional Authors: Jeffrey Coleman;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Members of the *Fusarium solani* species complex (FSSC) are pathogens of rising importance in both agricultural and clinical settings. The Coleman lab has successfully demonstrated that isolates from a clinical origin are capable of infecting and causing disease on produce as well as proving that some agricultural isolates can cause human infection. This pathogenicity has caused the need for further antifungal testing in both clinical and agricultural realms. Treating fungal infections is difficult because fungal cells and human cells share many basic structures as well as possessing the ability to easily develop resistance to drugs. The objective of this research is to investigate how the FSSC isolates from varying environments react to different antifungal agents, determining potential treatment options and exposing possible resistance. The minimum inhibitory concentration of various antifungal agents will be analyzed and compared to determine effectiveness. Ten-fold antifungal dilutions are added to a set number of spores and incubated for three days at thirty-five degrees Celsius. Fungal growth within each dilution is examined macroscopically to determine the minimum amount of antifungal needed to inhibit the growth of that particular infection. Agricultural antifungals such as Triadimeton show no inhibiting properties towards clinical isolates while Amphotericin B, a clinical antifungal, shows inhibition of both clinical and agricultural isolates. The concentration needed of each varies by isolate as well, indicating possible resistance. The FSSC has been denoted as a fungal species complex of particular concern by the WHO in 2022, and this research will contribute significant information surrounding treatment in both clinical and agricultural environments.

Title: Physiological response of DGRP lines to hypoxia and cold stress

Primary Author: Amelia May

Additional Authors: Laurie Stevison;Natalia Rivera Rincon;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: A major consequence of global climate change is the exposure to extreme fluctuations in temperature, forcing populations to shift in their ranges. One expected result would be the shift in the geographic range of species to occupy novel niches such as high-altitude environments. We examined the interaction between low oxygen and temperatures on fruit fly physiology. Based on previous work on the DGRP related to chill coma and response to oxidative stress, we selected five stocks, three mutually sensitive and two mutually tolerant to these two stressors. We crossed these stocks to a common tester stock with quadruple X-linked recessive visible mutant markers to assay changes in recombination. We then placed crosses in four possible treatment conditions throughout development – (1) control at 25°C and 21% Oxygen, (2) Low Temperature at 18°C and 21% Oxygen, (3) Low Oxygen at 25°C and 8% Oxygen, and (4) Combined at 18°C and 8% Oxygen. Oxygen concentration was controlled with the use of custom hypoxia chambers from Biospherix and certified pre-mixed tanks from AirGas. Here, I focus on the physiological results from these four treatment groups. Specifically, we measured individual changes for females and males in weight (N=377), oxygen consumption (N=284), carbon dioxide emission (N=284), and critical thermal maximum (N=283) across the five strains and four treatment groups. Our weight results showed a significant difference due to the interaction of sex, strain, and treatments. Using both oxygen and carbon dioxide exchange, we were able to measure respiratory quotients (RQ). Finally, our CTmax results showed a decrease in thermal tolerance in sensitive strains when exposed to low temperatures and hypoxia, while tolerant strains exhibited the highest values of CTmax across treatments and strains. Phenotypic attributes across four genetic loci were collected in D. melanogaster for the recombination data. This research will inform our understanding of how various genetic backgrounds can influence response to climate change.

Title: The changing role of occupational characteristics in socioeconomic health disparities

Primary Author: Amy Hudson

Additional Authors: Thomas Fuller-Rowell;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: The association between socioeconomic status on health outcomes is well established. However, the changing role of occupational characteristics in shaping health disparities is not well understood. Occupational and work environment characteristics as determinants of socioeconomic health disparities between 2004 and 2016 were examined using data from the US Health and Retirement Study (HRS) and a standardized occupational database known as the Occupation Information Network (O*NET). O*NET was linked to HRS participant data via occupation codes. The HRS study collects a wide range of measures, including socioeconomic indicators and a variety of health measures. We considered BMI, basic functional limitations, instrumental functional limitations, and self-rated health as indicators of health. Socioeconomic status measures were derived from self-reports of income, education, and wealth. Preliminary analyses showed that the positive relationship between socioeconomic status and health has not changed significantly between 2004 and 2016. However, the association between socioeconomic status and work characteristics during that interval has weakened. The association between work characteristics and health outcomes varied over time by population demographics, with some groups experiencing more changes than others. White men and women have experienced the most change in the relationship between work characteristics and health, while Black and Hispanic women experienced no significant change between 2004 and 2016. These trends may be related to shifts in technology, public health, and the American labor market that continue to affect the overall wellness of America’s working population.

Title: Exploring the Atomistic Processes Involved in Etching of MAX Phases

Primary Author: Ana-Maria Stratulat

Additional Authors: Konstantin Klyukin;Valentina Nesterova;

Department/Program: Materials Engineering

College: Samuel Ginn College of Engineering

Abstract: MAX phases are a family of bulk layered materials with the general formula Mn 1AXn, where M is an early transition metal, A is an element from groups 13 or 14 (e.g., Al), X is carbon and/or nitrogen, and n = 1, 2, or 3. Highly selective removal of Al atoms from the MAX phases (e.g., Ti2AlC) leads to the formation of 2D surfaces of MXenes (e.g. Ti2CTx, Tx = O, OH, F). The successful synthesis of high-quality 2D MXene layers from MAX phases depends on finding an etching process that is highly selective and passivates the synthesized 2D layers impeding further reactions with the environment. However, the atomistic mechanism of the etching reaction remains elusive. In this study, we investigate the electrochemical etching of TM2AlC (TM=Ti, V, Cr), with a focus on the effect of different chemical compositions, surface terminations, and electrolyte chemistry on the selectivity of the etching reaction. Using density functional theory (DFT) simulations, we assess the thermodynamics and kinetics of the etching process by calculating energy barriers associated with the extraction of Al and TM atoms, deintercalation potentials, and exfoliation energies.

Title: Angiotensin II impairs hypothalamic antioxidant defense mechanisms leading to neuroinflammation in hypertension

Primary Author: Andrew Aitken

Additional Authors: Vinicia Biancardi;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Oxidative stress is a central mechanism underlying Angiotensin II (Ang II)-induced enhanced sympathetic outflow within brain cardio-regulatory nuclei in neurogenic hypertension. A causal association between AngII, Nrf2 (nuclear factor erythroid 2-related factor 2), and sympathetic activity in neurogenic hypertension has not been explored. We hypothesized that increased Ang II in neurogenic hypertension impairs the Nrf2 signaling pathway within the hypothalamic paraventricular nucleus (PVN), leading to increased oxidative stress, inflammation, and sympathoexcitation. Using 12-week-old male spontaneously hypertensive rats (SHRs) and normotensive Wistar Kyoto rats (WKYs) we measured mRNA expression in PVN punches of the Nrf2 negative regulator Keap1 and Nrf2-based antioxidant defense genes (Gpx1 and NQO1). We then measured the protein expression of Nrf2, obtained by immunofluorescence (IF), and detected by confocal imaging in the subcellular localization of neurons and astrocytes within the PVN. The neuronal marker NeuN and the astrocytic marker GFAP were used for subcellular identification. We treated cohorts of SHR via oral gavage with the Ang II-type-1 receptor blocker Losartan (SHR-Los 20mg/kg, 4 weeks) or the vasodilator Hydralazine (SHR-Hyd 10mg/kg, 10 days), and blood pressure of all groups was measured indirectly. We found increased mRNA levels of Keap1 and reductions in Gpx1 and NQO1 in SHR ($p<0.05$), suggesting lower Nrf2 and associated antioxidant gene expression. Relative to WKYs, Nrf2 IF density was reduced in SHR neurons ($p<0.001$) and astrocytes ($p<0.001$). Following treatment, compared to WKY, only SHR-Los normalized BP ($p<0.001$) and Nrf2 protein expression in both neurons and astrocytes. These data support that compromised Nrf2 dynamics observed are due to Ang II signaling rather than elevations in blood pressure alone. Our studies aim to assess the role of Nrf2 on inflammation and autonomic dysfunction in hypertension.

Title: “NeuroCOVID-19” A contemporary and imminent global health concern: An extensive analysis of the detrimental impact on central and peripheral neuropathologies

Primary Author: Andrew Beasley

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Globally, viral infections continue to affect people of all ages, genders, and ethnicities resulting in substantial morbidity and mortality. The COVID-19 virus and its variants exhibit asymptomatic to severe pathological symptoms involving tissue/organ-based complications leading to fatality, which is a particularly noteworthy health concern. Alarmingly, there has been a steady and significant rise in various neuropathological complications (NeuroCOVID-19) as a consequence of COVID-19 exposure worldwide. Neuropathologies involve the central (brain and spinal cord) and peripheral (autonomic and somatic) nervous systems' physiological (biological/functional) and/or anatomical (bodily/structural) defects. Most existing studies consistently reported on the deleteriousness of COVID-19 on the common predominant or prevalent neurological disorders. However, very few studies have focused on the effect of COVID-19 on the less widespread and rare neuropathologies. Hence, the main goal of the current study is to evaluate the worldwide burden of different neuropathologies, neuronal injuries, and risk variables especially related to COVID-19 exposure. Furthermore, this study also compared the effect of NeuroCOVID-19 with Post-COVID and Long-COVID. Data were acquired from PubMed (NIH), WHO, and CDC using the keywords.

Title: Improving self-assembly and uniformity of cellulose gel beads with salt

Primary Author: Andrew Yingst

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cellulose gel beads can be used as a material in the biomedical sector for the removal of uremic toxins and the delivery of therapeutic drugs. Cellulose is both a renewable feedstock and biocompatible. In addition to this, the mechanical and transport properties of cellulose make it a suitable material for this application. Cellulose gel beads are fabricated through a dropping procedure into a hydrochloric acid coagulation bath. Examination of the fabricated beads shows non-uniformity using neat cellulose solution (containing cellulose, sodium hydroxide, urea, and water). The addition of salt to the cellulose solution improves the stability of the beads, improving uniformity. Salt drives the self-assembly of cellulose and impacts hydration. The salt in the solution counteracts the effects of salt formed by the reaction between the basic cellulose solution and the acidic coagulation bath. The microstructure of the beads can be further tuned by the concentration of the acid coagulation bath. The cellulose gel beads fabricated with salt concentrations showed improved uniformity, porous internal structures, and decreased batch-to-batch variability in size, circularity, and mechanical properties.

Title: RH-dependent phase transitions in submicron model respiratory aerosol particles

Primary Author: Angel Gibbons

Additional Authors: Paul Ohno;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Understanding the viability of viruses contained in respiratory particles and the connections between this viability and the physicochemical properties of the particles themselves is critical to mitigate respiratory disease transmission. The physicochemical properties of aerosols are influenced by environmental factors like relative humidity (RH) and temperature. Here we report using fluorescence probe spectroscopy to investigate the phase state of three model respiratory particles across a range of RH (30-80%). Phase separation between the organic and inorganic constituents was observed at an RH that was dependent on the composition of the particle system. Future directions, including applying this technique to study other physicochemical properties, will be discussed.

Title: Modeling ammonia to prepare for a nitrogen mass balance in an algal-bacterial system

Primary Author: Ann Inskeep

Additional Authors: Brendan Higgins;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: This study investigates the feasibility of altering poultry processing wastewater into a nutrient solution for hydroponic lettuce cultivation. Specifically, this research focuses on the nitrogen transformation to quantify and model various nitrogen components using a mass balance. An overarching goal of the overall project is to experiment and validate models of the transformation of nutrients, antimicrobials, and pathogens in poultry processing wastewater which is treated for irrigation in controlled-environment agriculture. Current methods have been unable to account for a sizable portion of nitrogen, but the use of Microsoft Excel closes the knowledge gap to quantify the degree and mechanisms of nitrogen modification in this system. With data collected from the third trial, Ammonia is currently modeled starting at the storage tank, through the algae and bacterial bioreactors, clarifier, bag filter, and UV treatment. Throughout the experiment, poultry wastewater is delivered and stored at the start of the system in the storage tank. Delivery days occurred on day 0, 9, 17, 28. With the current findings, the actual and theoretical nitrogen content has a wider difference starting at the storage tank. This is due to the delivery days in fluxing the overall concentration. The models reveal there is a smaller difference the further away the wastewater moves away from the original storage tank. The process of interpolation of the known ammonia will continue to be used throughout the next phases of the system such as the reservoirs. Once this is completed, the same process will occur with nitrite, nitrates, organic nitrogen, and phosphate. When this data is sorted, the sources where nitrogen is depleted will be determined and a full nitrogen mass balance will be conducted. The end result will be a comprehensive dataset of all the nitrogen entering and exiting throughout the whole algal-bacteria hydroponic system.

Title: Metabolomic analysis of bovine follicular fluid post-breeding in subfertile and fertile cross-bred beef heifers

Primary Author: Anna Holliman

Additional Authors: Paul Dyce;Priyanka Banerjee;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Unexplained subfertility in cattle is a widespread phenomenon that can affect up to 15% of cattle bred within a single season. One theory for this lower fertility is a high rate of early embryonic loss. As the *in vivo* maturation medium of oocyte development, follicular fluid is a prime candidate for exploring mechanisms for oocyte competence and development. This study aimed to identify differentially abundant metabolites in follicular fluid collected from beef heifers of differing fertility status. Crossbred beef heifers were subjected to estrous synchronization and fixed-time artificial insemination (AI) protocol. Heifers pregnant to AI were classified as fertile (n=8). Heifers that remained non-pregnant following AI were exposed to a bull of proven fertility and evaluated for pregnancy after the end of bull exposure. The non-pregnant heifers following AI and natural service were classified as subfertile (n=5). Pregnancies were terminated in fertile heifers at the time of pregnancy diagnosis, and heifers from both groups were allowed to resume normal cyclicity prior to the collection of follicular fluid. Follicular fluid was subjected to untargeted metabolomic profiling utilizing a GC-TOF-MS platform. Metabolomic profiles were analyzed with Student's t-test to elucidate significant differences in metabolite abundance. Fourteen metabolites were differentially abundant in the follicular fluid of cohorts ($p \leq 0.05$). Five differentially abundant metabolites were related to reactive oxygen species generation or response, two to infection or inflammation, and two to cell metabolism or follicular atresia. This study identified differences in the follicular fluid of un-synchronized animals, suggesting underlying ovarian processes may be playing a role in heifer fertility. However, further study with larger cohorts and integration of the metabolomic profile information with oocyte development studies is required to fully validate these metabolites and pathways.

Title: Internal erosion in unsaturated slopes: A laboratory study

Primary Author: Anna Lancaster

Additional Authors:

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Internal erosion is a mechanism that threatens the stability of earthen structures such as dams, levees, and natural slopes. This erosion can cause catastrophic failures which lead to significant environmental and societal repercussions. This research focuses specifically on the multi-stage process of concentrated leak erosion; focusing on its initiation, progression, and failure. By examining the relationship between hydro-mechanical properties and erosion rates within earthen structures, this study works to reveal the mechanisms that affect the stability of the earthen slopes. To examine these relationships, medium-scale laboratory experiments are used to simulate an earthen slope with subsurface flow while examining different factors such as soil type, density, and initial pipe diameter. Through data collection which encompasses erosion and flow rates, erosion progression, and sensor data, we aim to identify critical factors influencing internal erosion in unsaturated slopes. This study integrates the use of small sensors to monitor changes in both the water content and suction within the earthen slope, giving insight into the failure mechanisms of these voids under varying flow and soil conditions. Through this laboratory study, processes of internal erosion in unsaturated slopes will be better understood. This research aims to advance the predictive and monitoring capabilities for internal erosion, which is crucial for mitigating the risks associated with slope failures in vital infrastructures.

Title: Dietary arginine responses of Ross 708 broilers reared under a cyclic heat stress challenge

Primary Author: Annalise Anderson

Additional Authors: Samuel Rochell;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The objective of this study was to evaluate the effects of dietary arginine ratio on performance and processing characteristics of broilers subjected to a cyclic heat stress (HS) challenge model. A total of 1,200 male Ross 708 broiler chicks were fed common starter (0-17 d) and grower (17-27 d) diets before being fed 1 of 6 target digestible Arg:Lys ratios (80, 92, 104, 116, 128, and 140) across both finisher 1 (27-38 d) and finisher 2 (38-46 d) phases. Birds were reared in floor pens and treatments were replicated by 8 pens of 25 birds. At placement, barn temperature was set to 32 degrees C and decreased to maintain bird comfort until initiation of the HS challenge at d 28. From 28-47 d, barn temperature was maintained at 32 degrees C for 12 h daily and reduced to 24 degrees C each night. At 32, 39, and 46 d, cloacal temperatures were measured in 2 birds per pen during both the thermoneutral and HS period. At 48 d, 8 birds per pen were processed and deboned to determine carcass and parts weights and yields. Data were analyzed by one-way ANOVA with pen location as a random blocking variable. Linear and quadratic contrasts of Arg:Lys ratio were also used. Statistical significance was determined at $P \leq 0.05$. Feed conversion ratio (FCR) improved linearly with increasing Arg:Lys ratio from both 27-38 d ($P = 0.001$) and 27-46 d ($P = 0.012$), but no other effects on performance were observed ($P > 0.05$). Cloacal temperatures were decreased either linearly (46 d) or quadratically (32 and 39 d) by increasing Arg:Lys ($P < 0.05$). For processing characteristics, there were linear increases ($P < 0.05$) in chilled carcass and tender weights and yields with increasing Arg, with quadratic responses ($P < 0.05$) observed for breast fillet and total breast weights and yields. Overall, the results of this study indicate that in addition to improving FCR and 48 d processing yields, dietary Arg may also influence cloacal temperature in a dose dependent manner in Ross broilers subjected to a cyclic HS challenge.

Title: A multimodal study of vocal function and upper airway temperature in individuals with asthma vs. controls

Primary Author: Annie Pauley

Additional Authors: Mary Sandage;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Chronic inhaler use for asthma and its effects on vocal physiology and function are not well understood. This preliminary study aimed to understand upper airway temperature and vocal function differences in individuals with asthma versus healthy controls. Using a prospective between group design, 3 participants with asthma and 3 controls were recruited. Inclusion criteria: nonsmokers or not pregnant; no breastfeeding prior six months; no diagnosis of other respiratory disease, reflux, diabetes, neurological disease, or hormonal imbalance; take a maintenance inhaler daily (asthma group); and no drying medications (other than an inhaled corticosteroid). Following consent, posterior pharyngeal wall temperature was collected after 20 minutes of equilibration to lab environment with an infrared thermometer. Videolaryngostroboscopic imaging, acoustic, phonation threshold pressure (PTP), and perceptual measures were collected. Data were descriptively analyzed by group. Average upper airway temperature was 34.6ºC pretrial and 35.28ºC post-trial (ΔUAT 0.68ºC) for asthma volunteers pre-trial and 34.6ºC pre-trial and 35.2ºC post-trial (ΔUAT 0.53ºC) in controls. Average PTP for asthma volunteers was 7.79 cmH_2 O and 5.73 cmH_2 O for controls. The average Voice Handicap Index (VHI) score for the asthma group was 22.67 and 3.67 for controls. The average OMNI-VES score for asthma volunteers was 3 of 10, and controls was 0 of 10. The average Rate of Fatigue (ROF) Scale score in asthma volunteers was 2.33 and 0.33 for controls. UAT average, range, and differences pre- and post-trial were essentially the same in both groups. PTP values were higher in the asthma group by 2.06 cm H_2 O, which is consistent with clinical observations of more vocal effort reported secondary to voice use with asthma and from inhaler use. Average perceptual measures from the VHI were 19 points higher in participants with asthma than those who were in the control group.

Title: Treatment of male cats with adeno-associated gonadotropin-releasing hormone (GnRH) to achieve nonsurgical sterilization

Primary Author: Anniston Dodson

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

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: The overpopulation of stray cats significantly challenges animal welfare and public health. Traditional surgical sterilization methods, while effective, are resource-intensive, stressful to the animal, and require a veterinarian. A non-surgical technique would eliminate these barriers, remove the physical and psychological stressors associated with surgery, and reduce the number of animals euthanized. This study explores the potential of adeno-associated gonadotropin-releasing hormone (AAV-GnRH) treatment as a non-surgical alternative for cat sterilization. Adeno-associated virus (AAV) is a nonenveloped virus that can be modified to target cells and deliver DNA. Gonadotropin-releasing hormone (GnRH) is produced by the hypothalamus which acts on the anterior pituitary to produce follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These hormones act on the gonads to stimulate the release of testosterone in the male and estrogen in the female. The overproduction of GnRH should lead to the downregulation of GnRH through constitutive activation of the receptor. The hypothesis states that intravenous administration of AAV containing GnRH to male kittens at six weeks old will induce a reduction in testosterone levels and impair sperm characteristics, resulting in infertility. With four treated and four control (untreated) kittens, the study employed monthly ultrasounds from four months old to calculate total testicular volume (TTV), testicular mass, and percent body weight. Once the cats reached six months of age, they underwent electroejaculation (EEJ) monthly to analyze sperm number and characteristics. Preliminary results suggest a potential decrease in sperm production and quality and an elevation in testosterone concentrations. Ongoing research will refine and validate the efficacy of this innovative, non-surgical approach, offering a step towards addressing the challenges posed by feline overpopulation with ethical and practical considerations.

Title: The role of PEGMA as a blocking group in ion exchange membranes for CO_2 reduction products crossover

Primary Author: Antara Mazumder

Additional Authors: Bryan Beckingham;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: One promising approach to address the excessive emission of CO2 in the environment is electrochemical reduction of CO2. Electrochemical CO2 reduction cells generally consist of two cells named cathode (e.g. Cu) and anode (e.g. pt foil) separated by an ion exchange membrane (IEM). By following multiple electron-proton pathways, the CO2 is electrochemically reduced to number ofseveral products such as methanol, ethanol, formate, acetate etc. However, the one limitation of this process is the crossover of those products from cathode to anode that eventually reduces the faradic efficiency of the process. The major role of IEM here is to prevent the transport of various CO2 reduction products along with transporting the pertinent ions. Therefore, it is necessary to tailor the membranes systemically to block the transport of these products. Previously, to suppress CO2 reduction product crossover we introduced a series of uncharged comonomers, acrylic acid (AA, n=0, where n is the number of PEG repeat units), hydroxyethyl methacrylate (HEMA, n=1), and poly(ethylene glycol) methacrylate (PEGMA, n=5), where we observed the crossover of carboxylates were significantly suppressed in PEGMA-containing films in co-diffusion. To further understand this, we prepared a series of PEGMA (n=9)- containing films and measured the permeabilities and solubilities of these films to carboxylates (formate and acetate) and alcohols (methanol and ethanol) in one- and two-component mixtures. In one-component permeation, we observed permeabilities to all solutes being is increased with increasing PEGMA content (increased water volume fraction). However, emergent behavior was observed for the co-transport of carboxylates with alcohols. For instance, we observed the permeabilities to acetate in co-diffusion are decreased with increasing PEGMA content. This finding will be an interesting factor to consider while designing an ideal ion exchange membrane for electrochemical CO2 reduction cell.

Title: Gut microbiota and associated metabolites are minimally affected in younger and older adults following 10 weeks of resistance training.

Primary Author: Anthony Agyin-Birikorang

Additional Authors: Drew Fruge;Michael Roberts;Kevin Huggins;Donny Lamb;

Department/Program: School of Kinesiology

College: College of Education

Abstract: The human gut houses an intricate microbial community that includes trillions of bacteria capable of affecting numerous organ systems and functions in the host. Recent evidence in rodents suggests that short-chain fatty acids (SCFAs) produced by the microbiota may impact body composition and muscle accretion. We aimed to determine whether a 10-week resistance training (RT) intervention would alter gut microbe composition and increase fecal and circulating SCFAs in younger and older adults. Fecal and serum samples were collected from untrained younger (average of 22 years) and older (average of 58 years old) participants prior to and following 10-weeks of supervised, twice-weekly full-body RT. Body composition was measured with dual x-ray absorptiometry, vastus lateralis (VL) thickness was measured with ultrasound, fecal microbiome data from 16S rRNA gene sequencing was gathered, and serum and fecal SCFAs were measured with gas chromatography. RT significantly increased VL thickness and lean body mass ($p<0.05$) in both groups. Beta diversity analysis revealed differences between young and old participant microbiota, however, but there was no age, intervention, or interaction effect on alpha diversity ($p > 0.05$). Seven SCFAs were detected in the stool, with only hexanoic acid increasing from pre-to-post. Acetic acid was the primary SCFA detected in serum and was unchanged by RT. Our data highlights that 10 weeks of RT does not significantly alter the fecal microbiome of untrained adults. Also, SCFAs in the stool did not turn into SCFAs in the serum. This might be because colonocytes used them or the intestinal epithelium stayed intact. Further investigation may not be warranted.

Title: Impact of 3-D confinement on cell migration: Implications for senescence and ageing

Primary Author: Anya McDaniel

Additional Authors: Panagiotis Mistriotis;Farnaz Hemmati;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cell migration is vital for development, wound healing, and tissue regeneration. Unchecked motility can trigger pathophysiological events, such as cancer metastasis. Most such studies use two-dimensional surfaces, yet, in vivo, cells move through narrow, three-dimensional paths like micropores and channels. This confinement induces physical stress on cells, reshaping migration mechanisms and leaving the effects of confinement on aged and young cell migration still unclear. To compare cell motility in confinement, we fabricated polydimethylsiloxane (PDMS)-based microchannel devices with parallel 2D-like channels and perpendicular microchannels, varying in width and height, but a fixed length (L = 200 µm). Microchannel dimensions were ~10x10 sq.µm, ~10x3 sq.µm, and ~10x6 sq.µm. Cells with <18 passages were classified as early passage, while those with >25 passages were classified as late passage due to halted division and elevated senescence-associated beta-galactosidase levels. For each trial, early and late dermal fibroblast suspensions were added to a larger channel's inlet for pressure-driven flow. Experiments lasted 16 hours with imaging done every 10 mins. Cell entry, persistence, velocity, and speed in microchannels were measured for each device. Experiments were repeated thrice, and significance was determined using appropriate statistical tests. Early experiments showed late passage cells had a reduced speed and velocity with increasing confinement, exhibiting significantly higher persistence than their early passage counterparts. In further experimentation, we will delve into how key migration factors like myosin II, actin, focal adhesion, and nuclear hardening may be influenced in early and late passage cells by a hypoxic incubating environment. Our objective is to manipulate pathways for rejuvenating aged cells to emulate youthful behavior. This research targets alleviating cellular senescence's negative effects on function, offering potential solutions for age-related cellular decline.

Title: A survey of anti-viral pattern recognition receptors in the purple sea urchin

Primary Author: Ariel Sharpe

Additional Authors: Amelia Williams;Katherine Buckley;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Innate immune systems serve as the first-line of defense against pathogens. Conserved pattern recognition receptors (PRRs), (e.g., Toll-like receptors [TLRs], Nod-like receptors [NLRs], C-type lectin receptors [CLRs], and RIG-I-like receptors [RLRs]) detect signatures of microbial life and initiate immune responses. PRRs can be either transmembrane or cytoplasmic proteins and specifically bind pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs). Within vertebrates, RLR signaling and activation play an important role in the antiviral immune response. Upon binding RNA, RIG-I interacts with MAVS to recruit TRAF6 and activate the transcription factor NF-kB. This study presents an analysis of the cytoplasmic PRRs that detect nucleic acids in sea urchins. Previous analyses of genome sequences revealed complex repertoires of PRRs within sea urchin genomes, but this repertoire has not been analyzed in-depth. Using sequence similarity and conserved protein domains, potential RIG-I orthologs have been identified in the purple sea urchin (*Strongylocentrotus purpuratus*) genome. These sequences have been confirmed using polymerase chain reaction (PCR), gel electrophoresis and sequencing. Gene expression has been measured in various adult tissues (e.g., coelomocytes [immune cells], gut and gonad). Additional searches for RLR-associated molecules have identified orthologs of caspase activation and recruitment domain two (CARD2) and mitochondrial antiviral signaling protein (MAVS). These results illustrate the complexity of innate immunity in marine invertebrates.

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

Primary Author: Arth Nayak

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

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

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

Title: Anti-hormone therapy as an alternative to traditional spay and neuter

Primary Author: Arthur Zimmerman

Additional Authors: Douglas Martin;Aime Johnson;Emma Hruska;Malia Walton;Anniston Dodson;Gabrielle Schultz;Johanna Ehrhardt;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: It has been widely accepted in the United States that broad scale pet sterilization via spay/neuter is necessary to prevent cat and dog overpopulation and to reduce the rate of euthanasia. However, there are long-term risks to pet sterilization in both cats and dogs that necessitate alternative options to surgical interventions. For example, spayed/neutered cats and dogs have increased risks for feline cognitive dysfunction (FCD) or canine cognitive dysfunction (CCD), respectively, as well as increased incidence of obesity, urinary incontinence, certain cancers, diabetes mellitus and decreased life expectancy when compared to intact counterparts. Dysregulation of hormone feedback mechanisms along the hypothalamic-pituitary-gonadal (HPG) axis significantly contribute to these long-term risks, and therefore, we hypothesize that development of an anti-hormone antibody treatment to disrupt fertility would both functionally "sterilize" both cats and dogs while simultaneously reducing the risk of the long-term consequences associated with surgical spay/neuter. To study this, we used an innovative adeno-associated virus (AAV)-mediated anti-hormone antibody treatment in CD1 mice to test this alternative approach. Here, we examined changes in estrous cyclicity, hormone levels, ovarian follicle maturation and hormone receptor expression within various tissues. We report that treatment with anti-hormone antibodies significantly lowers hormone levels and disrupts estrous cyclicity, specifically leading to an increased time spent in the follicular phase. We also see changes in both number and maturation of ovarian follicles as well as hormone receptor expression within different tissues. Overall, AAV-mediated antibody treatments alter several biologically relevant variables that may affect fertility, and future studies will examine fertility via mating studies.

Title: Fluidized bed gasification kinetics model development using genetic algorithm for biomass, coal, municipal plastic waste, and their blends

Primary Author: Ashish Bhattarai

Additional Authors: Sushil Adhikari;Surendar Moogi;Manish Sakhakarmy;Sagar Kafle;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Developing a robust kinetic model for fluidized bed gasification is crucial for understanding the gasification behaviors of various feedstocks under different operating conditions. Eventually, this will eliminate the time and effort required for the experimentation. Numerous studies have been conducted to develop a gasification kinetic model for solid fuels. However, only a small amount of research has taken advantage of cutting-edge artificial intelligence tools, such as genetic algorithms for kinetic model development. Genetic algorithms provide a novel and promising path for model development by effectively optimizing the kinetic parameters based on the experimental data. This study aims to solve the inverse problem of chemical kinetics with the genetic algorithm as an optimization tool to develop a robust gasification kinetic model that targets a variety of feedstocks, such as biomass, coal, municipal plastic wastes, and their blends. A dataset (synthetic gas compositions, tar compositions, and char yield) obtained by conducting oxy-steam fluidized bed gasification experiments of various feedstocks, including southern pine biomass, lignite coal, municipal plastic waste, and their twelve different blends have been utilized to develop and validate gasification kinetic model. The genetic algorithm-based model has exceeded the limitation of conventional approaches by autonomously fine-tuning the kinetic model parameters to match experimental results, resulting in a reliable representation of gasification kinetics. The results generated by the developed model show a good fit with the experimental data, including synthetic gas compositions, tar compositions, and char yield. The model developed in this study will benefit enterprises working in biomass and coal gasification processes. The model can be utilized to predict synthetic gas, tar, and char yield from fluidized bed gasification of a wide range of feedstock under different operating conditions, reducing the technology deployment risks.

Title: Exploring the impact of artificial intelligence on depression

Primary Author: Ashleigh Farmer

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Depression is a common illness that affects over three hundred million people around the world per year. Depression affects mood, causing people with it to suffer from low motivation, sleep hygiene, and productivity at work/home and through almost every aspect of their lives. Individuals with depression experience sad and empty moods for many days and weeks in a row. They feel hopeless and tend to have thoughts related to hurting themselves. If not treated, depression can become a serious health condition, leading to possible adverse outcomes like suicide. Suicide takes more than a hundred thousand lives per year. Although treatments for depression exist, most sufferings do not have access to them due to affordability, lack of professional health providers diagnosing, and the social stigma associated with mental disorders. Due to these challenges, an alternative treatment plan involving Artificial Intelligence (AI) has been developed, attempting to overcome depression and its symptoms. Recent studies have shown that certain computer-assisted therapy and conversational chat boxes can provide another treatment option for individuals suffering from depressive illness. This AI option supplies suffering persons with a more reasonable, reachable, and cost-effective solution. Another possible role AI could take regarding depression includes detecting signs of the illness itself. AI can do this by interpreting data from social media and other platforms. The AI could potentially aid trained health professionals in making a targeted diagnosis of the illness. With depression affecting so many throughout the world, this testing and discovery of AI within the medical field could lead to more healing and prevent poor outcomes of depression like suicide. The role and effects of AI on depression are the subjects of the current section of this study.

Title: Evaluating the sensitivity of phytoplankton to copper sulfate pentahydrate at industry standard doses in hypereutrophic communities

Primary Author: Ashley Hennessey

Additional Authors: Alan Wilson;Tham Hoang;Sathya Sandarenu Ganegoda;Suzanne Tenison;Kate Merrill;Matthew Gladfelter;Peyton Poe;Michael Mcdonald;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Harmful algal blooms can cause severe economic and ecological problems in both natural and managed systems that often require toxic chemical treatments, such as copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$) to prevent damaging effects, such as fish mortality and the production of off-flavor compounds. Phytoplankton communities treated with copper sulfate pentahydrate are expected to become more tolerant to CuSO4*5H2O treatment, which could make blooms difficult to manage over time. To test this hypothesis, the toxic effects of CuSO4*5H2O were evaluated at a standard dose (348 µg/L Cu) and a low dose (174 µg/L Cu) relative to an untreated control. Treatments were applied once to 1,000 L mesocosm enclosures installed in a productive aquaculture pond at the start of the experiment and monitored for 28 days using the pollution-induced community tolerance (PICT) methodology, which measures photosynthetic efficiency across a broad range of 5 µg/L to 300,000 µg/L copper concentrations in acute short-term bioassays via effective quantum yield (QY), a measure of photosystem II efficiency. The results of the bioassay were applied to create half-maximal effective concentration (EC50) dose-response curves that can be utilized to determine sensitivity to copper. Results from this experiment indicated that both doses of CuSO4*5H2O resulted in >99% removal of cyanobacteria in the first 7 days and reduced cyanobacteria by at least 70% throughout the experiment. The low and standard doses had a higher tolerance than the untreated communities. Tolerance peaked three days after the treatments were applied and remained high for at least fourteen days. These data suggest that a lower dose of copper sulfate is equally effective at treating harmful algal blooms dominated by cyanobacteria with slower community tolerance build-up and that repeated treatments of copper sulfate might be least effective during the fourteen days after treatment. These conclusions could be transformational for informing water managers on the most effective methods for managing harmful algal blooms.

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

Primary Author: Ashli Evans

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

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: Cost-effectiveness of the Brexu-cel in relapsed/refractory mantle cell lymphoma and B-cell acute lymphoblastic leukemia: A systematic review

Primary Author: Asmita Priyadarshini Khatiwada

Additional Authors: Surachat Ngorsuraches;Ahmed Mostafa Ahmed Kamel;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: This systematic review explores the existing evidence on the cost-effectiveness analysis (CEA) of Brexucabtageneautoleucel (brexu-cel) across different international jurisdictions. A systematic search of articles on Embase, Medline, Econlit, Web of Science, Scopus, grey literature, and Health Technology Assessment (HTA) reports was done until 25 November 2023. Original English articles and HTA reports from different countries assessing the cost-effectiveness of brexu-cel inmantle cell lymphoma (MCL) and acute lymphoblastic leukemia (ALL) were included. Of the total 136 records, 22 articles underwent full-text review after the title and abstract screening, 5 met the inclusion criteria and were included with 4 HTA reports from Australia, Canada, Scotland, and England. The CEA studies were from the US, England, Canada, and Italy, with varying perspectives. The discount rates in these studies varied between 1.5% and 5% annually. The lifetime horizon was considered uniformly, mainly using a partitioned survival model. The model input data from the ZUMA-2 and ZUMA-3 trials were used for brexu-cel, with comparisons from their respective trials or literature. The comparators varied across these CEA studies, which included the standard of care (SoC) treatment or salvage therapy for relapsed/refractory (R/R)MCL and R/R ALL. Brexucel's incremental cost-effectiveness ratios (ICERs) were £67,713, €64,798, $88,503, and $31,985 per quality-adjusted life year (QALY) versus the respective comparators in England, Italy, Canada, and the US, respectively. Brexu-cel was found cost-effective in England, Scotland, Italy, and the US but inconclusive in Canada and Australia. Some key influencing parameters of cost-effectiveness results included the drug acquisition costs and long-term survival assumptions. The ICERs of Brexu-cel per QALY were relatively high across the various countries. However, the cost-effectiveness results were contingent on the model uncertainties and clinical data extrapolation for the long-term effect, which should be carefully considered when making decisions.

Title: Using a Relational cultural framework to examine acculturative stress among South Asian international students

Primary Author: Asmita Saha

Additional Authors:

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

College: College of Education

Abstract: International students experience various forms of acculturative stressors, such as language difficulties, academic pressures, perceived discrimination, homesickness, loneliness, cultural differences, and lack of social support. Since these stressors can lead to international students' disconnection from their host society, their peer, mentor, and university community relationships can function as a means of ameliorating the negative effects of acculturative stress and enhancing resilience. Relational Cultural Theory (RCT) has served as a feminist and social justice theory that emphasizes the importance of relationships and connection to cultural context. Given its unique focus on the importance of relationships, this theoretical approach offers a salient premise for understanding the cultural adjustment experiences for cultural minority groups. RCT posits that this dysfunction in connecting with others is a major source of distress, and improving the quality of our connections with others can support greater psychological well-being. Since historically marginalized communities (e.g., women, Black, Indigenous, and People of Color) prioritize community and collectivistic values, infusing RCT tenets into understanding the experiences of international students can directly address mental health and psychological well-being for international students. Along with this, applying tenets of RCT in approaches to working with international students can address the foundational sources of distress for them. Therapeutic interventions like RCT-oriented therapies could help international students consider ways they might go about deepening their connections to others. Such interventions might explore how to build meaningful relationships with others from a culturally sensitive lens that includes approaches which acknowledge the ways international students understand relationships and challenge them to explore growth-fostering relationships with domestic students in the U.S.

Title: Effects of rear-foot center of pressure on the application of forces during softball hitting

Primary Author: Aubrie Lisenby

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

Department/Program: Sciences Center Laboratory

College: College of Sciences and Mathematics

Abstract: Softball hitting requires a synergy of sophisticated biomechanics for optimal performance. Loading of the rear leg is a key portion of the swing, facilitating the generation and transfer of momentum. Though loading patterns differ between individuals, a commonality is a pressure shift into the rear leg, followed by an increase in force production during the down swing. Despite this, however, loading strategies remain an overlooked topic with regards to softball hitting. This research aimed to addresses an often-overlooked knowledge gap in softball hitting in determining whether the tactic hitters use to load the foot of the rear leg impacts their ability to generate momentum during their stride. Kinematic and force data were collected simultaneously on ten Division 1 National Collegiate Athletic Association softball hitters. To ensure repeatability, each player performed five swings off a tee positioned to ensure a natural swing. To determine the effects of loading the rear foot, the average displacement of center of pressure (CoP) on the rear foot was examined during a hitter's load and stride phases. Center of Pressure was evaluated with an impulse-momentum approach, with impulse being normalized to the participant's body weight. An increase in CoP at a point more lateral on the foot (outside) was significantly moderately associated with an increased shear impulse in the direction of the swing towards the tee, and significantly strongly associated with an increased shear impulse directed superiorly (upwards). These associations provide grounds for future research and insights for refining hitting techniques which may apply to other mechanics and performance.

Title: Nutrient release characteristics of a novel poultry-litter derived fertilizer

Primary Author: Austin Lindquist

Additional Authors: Glenn Fain;Jeremy Pickens;Eve Brantley;Rishi Prasad;Paul Bartley;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Poultry litter, a common soil amendment, can be applied to soils as a plant nutrient source. Due to a balanced nitrogen: phosphorous ratio applying poultry liter based on nitrogen rates may result in an overapplication of phosphorous. Increased phosphate levels may result in eutrophication within aquatic environments. To reduce contamination risks, poultry litter can be altered through several different processes, such as anaerobic or aerobic digestion, and pelletized for more uniform product distribution. Product assessments were made of a proprietary process which combines aerobic digestion and ammonification to alter poultry litter physically and chemically. Through this process, standard poultry litter is transformed from a 1.5-1.5-1.5 N-P-K chemical formulation to a 11.5-2-2 N-P-K granulated product (C&G fertilizer). Nutrient release rates were investigated using a soil incubation test and a rapid water incubation test. Nutrient release rates in soil were evaluated at a 1.5 lbs. N/yd3 rate with soil maintained at 0.3 cm3/cm3 volumetric water content at 30 Celsius over a 55-day period. Rapid water incubation was conducted by adding one gram of fertilizer (C&G, Synthetic, or Osmocote) to 100 milters of water for 24-hour period. Electric conductivity was monitored to evaluate nutrient release over time. Within the first 10 minutes, 82% of C&G and 95% of synthetic nutrient release had occurred in water-based method. Osmocote had the slowest and most variable release rate. In soil, significant and increasing quantities of phosphorous, potassium, ammonium, and nitrate were released in the first six days of incubation. After six days, nitrate and potassium continue to increase while phosphorus and ammonium plateaued in release. Initial results suggest the C&G fertilizer may be utilized similarly to synthetic, uncoated fertilizers.

Title: The size of college football stadiums and the towns they are in: Are all towns equipped for college football mass gatherings?

Primary Author: Avery Nobles

Additional Authors: Ashley Hawthorne;Matthew Loop;Emma Redman;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: College football games had more than 47 million attendees in 2019. Mass gatherings in small communities can strain local resources, including emergency departments (EDs). The objective of this study was to conduct a retrospective, descriptive analysis among municipalities with “Power 5” football programs, focusing on stadium size and measures of municipal resources, such as population, distance to the closest ED, and presence of a teaching hospital. “Power 5” football programs were defined as members of the Big 12, Southeastern, Big 10, Pac-12, or Atlantic Coast conferences. We calculated summary statistics (medians, quartiles, and percentages) and conducted an unsupervised machine learning analysis with K-means clustering to group schools based on many of these factors. Among the schools and municipalities we identified (n=66), the median(quartile 1, quartile 3) football stadium size was 62,061 seats (51,576, 79,985), with the smallest median stadium size being for the Pac-12 (52,722) and the largest being for the Southeastern Conference (82,801). The K-means algorithm with 4 clusters identified the following: a “rural” cluster with smaller municipal populations, smaller numbers of beds in the ED, and no teaching hospital (n=19); a “university hospital” cluster with smaller stadium capacities, shorter distances to the closest ED, and larger numbers of beds in the ED (n=23); a “big stadium/big community hospital” cluster with larger municipal populations, larger football stadium capacities, larger numbers of beds in the ED, and longer distances to the closest ED (n=22); and a “Los Angeles” cluster (n=2). Municipalities with a “Power 5” football team vary in terms of the size of football gatherings (using stadium capacity as a proxy), as well as by ED capacity. The stress that football gatherings place on the health system may vary, with municipalities in the “rural” cluster with large football stadium capacities potentially bearing the most significant stress.

Title: Production of aviation fuel-range hydrocarbons through the catalytic co-pyrolysis of polystyrene and Southern Pine

Primary Author: Ayden Kemp

Additional Authors: Sushil Adhikari;Hossein Jahromi;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Thermochemical conversion techniques such as pyrolysis and gasification have been frequently studied as a generalized method for converting waste materials, including biomass and plastic waste, into various energy-containing compounds. Co-pyrolysis of blends of renewable and non-renewable resources can simultaneously offer a means of managing waste and producing fuels of higher quality than the pyrolysis of renewable resources alone. Catalytic co-pyrolysis of biomass and waste plastics is an attractive means of producing fuels with lower oxygen content because the plastic feedstock serves as a source of hydrogen for catalytic hydrodeoxygenation processes. In this study, polystyrene (PS), with its repeating structure consisting of aromatic rings, was identified as a prime feedstock to produce polycyclic aromatic hydrocarbons (PAHs) and naphthenes which together compose approximately 40%%20 of kerosene-based jet fuels. The yields of organic-phase oil per unit mass of feedstock were increased from 4%%20 for pure pine to 40%%20 for oil obtained from a 1:1 blend of pine and PS with ZSM-5 catalyst, with pure PS pyrolysis producing approximately 85%%20 organic-phase oil per unit mass. It was observed that the addition of ZSM-5 catalyst increased the yield of kerosene-range (C7-C16) aromatic compounds from PS by 10%. Furthermore, the co-pyrolysis of pine and PS in an equal-parts blend demonstrated synergistic effects by increasing the yield of kerosene-range aromatic compounds by 21%. The maximum yield of kerosene-range compounds obtained from co-pyrolysis of pine and PS was 70%. The results of this study demonstrate the potential for the conversion of biomass into sustainable aviation fuels via catalytic co-pyrolysis with waste PS. The addition of PS to pine biomass demonstrated synergistic effects that both increased the yield of organic-phase oil and the distribution of kerosene-range hydrocarbons while decreasing the oxygen content of the pyrolysis oil.

Title: Exceptional fracture behavior of cellulose nanopaper under quasi-static and dynamic loading

Primary Author: Azeez Adekunle Adebayo

Additional Authors: Burak Aksoy;Hareesh Tippur;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: This study introduces Cellulose Nanopapers (CNP), a groundbreaking material with the potential to revolutionize industries through its biodegradable, eco-friendly nature and superior mechanical properties. Developed from cellulose nanofibrils (CNF) and processed into sheets with thicknesses between 50 and 200 micrometers using a refined hand sheet method recommended by the Technical Association of the Pulp and Paper Industry (TAPPI), CNP exhibits an elastic modulus of approximately 10 GPa, surpassing traditional plastics in strength. The research focuses on CNP's enhanced tensile strength, fracture resistance, and ability to resist crack propagation, making it an ideal material for applications in aerospace, automotive, electronic packaging, and other areas where the balance between lightweight characteristics and robust strength is key. Utilizing digital image correlation (DIC) for the assessment of tensile and fracture responses under quasi-static conditions, the study determines CNP's fracture toughness to be approximately 10 MPa m^1/2, markedly surpassing that of traditional plastics such as PMMA, which exhibits a fracture toughness of 1.0 MPa m^1/2. Additionally, dynamic crack growth experiments involving ultrahigh-speed photography and DIC, combined with the use of a long-rod impactor, further validate CNP's durability under high strain rates, showcasing its enhanced performance in dynamic conditions. These findings underscore CNP's exceptional crack growth resistance, particularly at a 100-micrometer thickness, and highlight its robustness against high strain rates. The comprehensive analysis reveals CNP as a sustainable alternative to conventional plastics, offering valuable insights into its failure mechanics and establishing new standards for material innovation geared towards environmental sustainability and mechanical performance.

Title: Development of a pipeline for low-thrust and impulsive trajectory design and validation in GMAT

Primary Author: Barbara Brogan

Additional Authors:

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: The main objectives of the proposed research project are to develop a pipeline for validating and verifying low-thrust trajectories generated using optimal control theory in one of NASA's trajectory optimization tools, the General Mission Analysis Toolkit (GMAT), and to enable low-thrust trajectory design in GMAT by providing externally generated, high-quality initial guesses to it. The proposed research consists of tasks related to generating initial guesses for both low-thrust and impulsive trajectory optimization problems. Low-thrust propulsion systems have garnered significant attention due to their potential for reducing mission costs and enabling extended mission durations. However, their continuous and low-thrust nature presents unique challenges in trajectory optimization compared to traditional impulsive propulsion systems. These challenges necessitate the development of sophisticated trajectory design methodologies that can accommodate various mission constraints and objectives. To tackle these challenges, this research project leverages optimal control theory techniques to accurately model and optimize low-thrust trajectories within the GMAT framework. The pipeline integrates advanced numerical algorithms and methodologies to generate high-quality initial guesses for low-thrust trajectory optimization problems. By combining these approaches, the research aims to improve the convergence and efficiency of the optimization process within GMAT, ultimately leading to more accurate and reliable trajectory solutions. By combining techniques from optimal control theory with GMAT's abilities, the research project hopes to make it easier to plan low-thrust paths that are both efficient and reliable for a wide range of space missions. This will ultimately help space exploration and technology move forward.

Title: Scalable production of microfluidic devices for hydrogel microsphere production

Primary Author: Benjamin Gunasekaran

Additional Authors: Elizabeth Lipke;Yuan Tian;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Hydrogel microspheres provide microenvironments for the growth of encapsulated cells into 3D tissues. Rapid and uniform production of these cell-laden microspheres is necessary for their application in drug testing and the development of implantable biomaterials. A microfluidic device is used to achieve this scalable production through the formation of cell-laden droplets of poly(ethylene glycol)-fibrinogen precursor solution, which is subsequently photo-crosslinked into hydrogel microspheres. This research focuses on developing a technique for the efficient manufacture of the microfluidic device. The current fabrication method involves manually hand-molding and curing poly(dimethyl siloxane) (PDMS); however, this process is difficult to replicate without human error. Consequently, discrepancies between hand-molded PDMS microfluidic devices result in the production of hydrogels of varying quality and adversely impact downstream experiments. Alternatively, resin-printing microfluidic devices can produce microfluidic devices of uniform quality. Using this technique, two components are separately designed and printed. One component is printed with channel grooves and inlets, while the counterpart is flat. These two components are attached together using screws to form a microfluidic device with sealed channels. The resin-printed microfluidic devices have uniform dimensions and produce uniform hydrogels for downstream experiments and applications. In the future, the components will be produced via injection molding for quicker manufacture.

Title: Improving reliability of atomic fluorescence efficiencies for solar system science

Primary Author: Benjamin Lightfoot

Additional Authors: John Noonan;Dennis Bodewits;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Comets, as the best-preserved remnants of planetary formation within our solar system, are often likened to time capsules: a comet's icy core, or nucleus, contains clues about how the solar system and the Earth emerged, and allows us to study the materials that they formed from. When a comet enters an orbit that brings it close to the Sun, this ice sublimates to space and produces a cloud spanning hundreds of thousands of kilometers, which contains chemical information from the early solar system. However, characterizing the atoms within the cloud (or coma) requires a property known as the fluorescence efficiency, describing how easily those species produce photons in the solar light. Unfortunately, ultraviolet fluorescence efficiency calculations demand access to a high-resolution solar irradiance spectrum, which in turn requires calibration with daily cadence observations – a process marked by uncertainty. Steps for obtaining precise fluorescence efficiencies have thus been both cumbersome and customized, with substantial variation in the literature that could be attributed to disparity in the solar spectrum quality, cadence, and scaling. The focus of this research has been the development of a comprehensive fluorescence efficiency model for atomic species that will address some of these challenges. Implementation of automated data querying and spectral stitching has dramatically improved the versatility, efficiency, and traceability of the existing software, paring a multi-faceted problem down to what is largely an issue of scaling. Furthermore, these improvements have paved the way for greater insight regarding sources of error embedded in prior scaling methodologies, which appear to be minimizable through application of techniques such as Gaussian convolution and polynomial fitting. The integration of these results into a flexible, user-friendly interface will produce a tool that will significantly aid in the analysis of atomic species.

Title: Investigating yellow-pigmented catfish pathogens

Primary Author: Benjamin Marshall

Additional Authors: Courtney Harrison;Timothy Bruce;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: The bacterial genera *Flavobacterium* and *Chryseobacterium* are ubiquitous within soil, marine, and freshwater environments and are collectively referred to as yellow-pigmented bacteria (YPB). The *Flavobacterium* spp. are pathogenic to wild and cultured fish species worldwide, and an increasing number of *Chryseobacterium* spp. have also been reported as emerging pathogens. Recently, several YPB have been recovered from catfish and other freshwater species following mortality events in Alabama, where YPB were primary in causing infection. With the knowledge of YPB as a threat to aquaculture, it is critical to identify the pathogenic potential of these YPB and understand their susceptibility to antibiotics approved for use in aquaculture. Collected YPB were revived and grown on an array of growth media, including tryptic soy agar (TSA), modified Shieh agar (MSA), Hsu-Shotts agar, and tryptone yeast extract salt (TYES) agar. Genomic DNA was extracted and phylogenetic analyses from the gyrase subunit B (gyrB) gene suggested that four YPBs were allocated into the genus *Chryseobacterium*, with three isolates belonging to unidentified clades. Three isolates were assigned to the genus *Flavobacterium*, where two fell into unidentified clades. Whole genome sequencing of the genus-level identified isolates was performed using long-read technology on the GridION (Oxford Nanopore Technologies) platform for genome assembly and annotation. Minimal inhibitory concentrations (MIC) analyses will be performed to determine the susceptibility to antibiotics used in aquaculture. Additionally, growth kinetic experiments will characterize our YPB and be used to guide virulence assessments in channel catfish (*Ictalurus punctatus*) to elucidate their pathogenic potential. The outcomes of this project include identifying emerging YPB, characterizing their virulence in a highly valued aquaculture fish species, and identifying potential approaches to mitigating disease outbreaks

Title: An investigation into statewide programs and resources for groundwater users in the United States

Primary Author: Bethany Foust

Additional Authors: Stephanie Rogers;Eve Brantley;Jessica Curl;Ann Ojeda;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Groundwater from private wells serves as the main drinking water source for roughly 15 percent of the United States population. Water from private wells is not federally regulated, and policies concerning water from wells vary by state, so most private well owners are responsible for the management of their drinking water. Properly managing drinking water is critical for ensuring that it is not contaminated and does not lead to serious health issues. However, finding information about management strategies can be difficult. Well owners need support and educational opportunities so they can make informed decisions about how to manage their water to avoid potential risks. Some states have private well programs (PWPs) to fill this need. PWPs are non-regulatory bodies established through various agencies (e.g., Cooperative Extension or health departments) that provide guidance to well owners in a variety of mediums like workshops, webinars, or videos. Because these programs are initiated and managed at the state-level, there is not a clear picture of the PWP resource landscape across the US. This inventory aims to identify PWPs, describe the organizational structure, and highlight areas that may need more resources to help people safely manage their water. All 50 states were inventoried using internet search methods to identify the presence of PWPs and resources. Interviews with five PWP coordinators in Alabama, Mississippi, Oregon, Texas, and Virginia were conducted via Zoom to elucidate how PWPs were created and how PWPs help well owners. Inventory results show that 64% of states have PWPs (n = 32), 18 percent have resources (n = 9), and 18 percent have no resources that were found (n = 9). Of the states that did have PWPs, Extension houses the most across the nation (n = 22, 69 percent of total). All interviewees said if they could leave one thing with well owners, it would be to test their water. This inventory can be used by well owners to access information and note areas that may need more resources.

Title: Valorization of tomato plant residue through hydrothermal liquefaction to produce high-value chemicals

Primary Author: Bipasyana Dhungana

Additional Authors: Sushil Adhikari;Hossein Jahromi;Manish Sakhakarmy;Bijoy Biswas;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Effective management of waste residue generated during the harvesting and processing of agricultural products is crucial to establishing eco-friendly pathways for a sustainable economy and environment. These waste residues can be recognized as a renewable source of energy or valuable chemical production using thermochemical conversion processes. Hydrothermal liquefaction stands out as one of the most promising pathways for agricultural residue management and fuel production. This study aims to characterize tomato plant waste residues to understand their composition and properties, evaluating their feasibility and effectiveness in producing bio-chemicals via the HTL process. HTL of tomato plant residue (stem, leaves, and vines) was studied at temperatures of 260, 290, and 320 C and under different reaction solvents (water, ethanol, and methanol) for a reaction time of 30 minutes. The obtained bio-oils and bio-chars were characterized by GC-MS, FT-IR, 1H &13C-NMR, SEM, XRD, and elemental analysis. The product yield showed that by using an alcoholic solvent the bio-oil yield significantly increased. The maximum bio-oil yield of 37.14 wt.% was observed with the use of methanol as solvent compared to water with 10.0 wt% and ethanol with 32.86 wt% solvents at 290 C. GC-MS analysis revealed that bio-oil mainly consisted of ester, phenolic, carbonyl, and nitrogen-containing compounds. The findings of this research highlight the potential of the HTL process as a viable and environmentally friendly solution for sustainably managing agricultural waste residue and the production of high-value chemicals.

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:

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 to those observed in our functional studies of the non-canonical Wnt1/Wnt8-Fzd5/8-Sp5-JNK signaling pathway. To determine the GRN components downstream of Fzd5/8 and ROR1/2 signaling performed RNA-seq analysis at four distinct stages during early AP axis patterning. Our co-expression analysis of these results highlights a new putative transcriptional regulatory network activated in the central ectodermal territory during blastula stages by Wnt8-Fzd5/8-JNK signaling. 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: To be aware or not to be aware: Investigating the support for facets emotion dysregulation

Primary Author: Brianna Crumly

Additional Authors:

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Much of human sciences or psychological research is distinct from other fields in that constructs of interest are not able to be objectively measured or even directly observed. There is no blood test that can determine an individual's level of happiness or their personality traits. Instead, researchers use theory and past scholarly findings to develop subjective instruments aimed at capturing constructs of interest. However, through this process, there tends to be discrepancies in how the unobservable construct would be best captured and what sub factors they are composed of. One construct currently entangled in this dilemma is emotion dysregulation (ED). ED is a transdiagnostic factor underlying multiple adverse psychological and behavioral outcomes and of high importance in intervention work, yet there is not a consensus among researchers on the definition of or facets which compose ED. In general, researchers confer that clarity or attention to emotions, impulse control, and the use of regulation strategies are sub-factors of ED. Yet there is disagreement among theoretical and empirical literature regarding if emotional awareness is a facet of ED or a related, but distinct, process. This talk will present an in-depth review of the literature regarding the importance of understanding ED and the proposed facets of ED, with a focus on the scholarly citations used by researchers to support their design. Implications regarding sound research logic and the importance of nuance when reporting past findings in theory building will be discussed.

Title: Who to turn to when I need someone to turn to? Exploring the help seeking behaviors of military service members

Primary Author: Brianna Gordon

Additional Authors: Mallory Lucier-Greer;Allison Tidwell;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: The military provides service members with many forms of mental health care to promote their readiness to perform their duties. This study explores help-seeking behaviors among service members experiencing stress and how these behaviors vary based on one's identity as religious or spiritual. The help-seeking behaviors of religious and/or spiritual (R/S) service members may differ from the nonreligious and nonspiritual (non-R/S) service member, including the frequency in which they seek support and the type of provider they seek. This study: (1) describes the types of providers service members turn to most frequently (N = 9,236), and (2) examines the differences of help-seeking patterns based on whether soldiers identify as R/S (n = 7111) or non-R/S (n = 1439). Secondary data analysis was conducted using data from the Army Study to Assess Risk and Resilience in Servicemembers (STARRS) dataset. Most (68.2%) soldiers did not seek help from any professional even though they reported ongoing life stress. There was no significant difference whether soldiers sought help, generally, based on if soldiers identified as R/S or non-R/S ($LR\chi2$ (1) = 2.507, $p = 0.113$). However, R/S soldiers were more likely than non-R/S soldiers to seek help from a chaplain or clergy member ($LR\chi2$ (2) = 35.907, $p <$ 0.001). It appears there is a gap between the need for mental health services and actual help seeking among soldiers. Although R/S soldiers tended to turn to a chaplain or clergy member to manage their stress more than non-R/S soldiers, R/S soldiers also sought support from other providers and some non-R/S did seek help from religious-affiliated providers. Chaplains and clergy members can still be resources to learn coping strategies.

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;Rafael Bernardi;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: The demand for data storage is increasing at an unsustainable rate, presenting a challenge in developing large, long-term storage systems with current technology. Biomolecules, such as DNA, offer a sustainable option to meet the continuously increasing demand for data storage. However, a major bottleneck in using DNA for data storage is our limitations in reading out encoded data. Efforts have been made to utilize 3D nanopores for sequencing single-stranded DNA (ssDNA) molecules. These efforts have proven successful, yet they still face limitations for use in computer devices. More recently, the use of 2D nanomaterials has been proposed as a better alternative, specifically a nanoscale monolayer composed of hexagonal boron nitride (hBN) and a graphene lattice. In this study, we investigate how ssDNA interacts with both hBN and graphene. We conducted molecular dynamics simulations of ssDNA molecules in a box containing the 2D material. The material was an hBN layer partially covered by a graphene layer, forming a tapered 2D pore that could potentially be used for detecting ssDNA molecules. Our preliminary results indicate the potential for an electric field to effectively drive ssDNA through the groove, suggesting a promising avenue for advancing DNA-based data storage technologies.

Title: Sequencing sex chromosome telomeres to quantify sex-specific aging in the wild

Primary Author: Brynleigh Payne

Additional Authors: Tonia Schwartz;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Telomeres are protective sequences of DNA located at the end of a chromosome that are pertinent to the maintenance of cell survival. Knowledge of the sequences of telomeres on sex chromosomes is especially limited due to their highly repetitive nature and high GC content. We optimized a method to sequence chromosome specific telomeres in the lizard, *Anolis sagrei*. Nanopore sequencing allows a single, long read through the telomere, providing chromosome level information that is not acquired through other quantification methods such as qPCR. The aims of this project are to answer the questions (1) What effect does sex have on telomere length across the lifespan? (2) Do the telomeres on the X and Y chromosomes degrade at different rates? To address these questions, two sequencing trials were planned. The first trial took an adaptive sequencing approach to only enrich for telomere sequences in male and female hatchlings and adults. Each sample met the Nanopore requirement for good quality reads. The total number of reads sequenced was 19,353 and the average read length of those reads was 6,785 bp. Findings from the first trial suggest that although the adaptive sequencing collected tandem repeats, many did not map to the ends of the reference genome, possibly due to unsequenced regions between the ends of the assembly and where the telomeres begin. Due to this delay in the bioinformatic stage of analysis, telomere quantification from the first sequencing trial is still underway. Moving forward, in the second trial, I will perform a revised Nanopore sequencing method, with the addition of TeloTags, to target the telomere lengths in longitudinal blood samples of both males and females. This research will provide insight on the relationship between sex and telomere length at the chromosomal level, and how this changes with senescence. In addition to filling a gap in knowledge, this research will improve the quality of the *Anolis sagrei* draft genome assembly.

Title: A landmark-based assessment of humeri and femora from a highly fragmentary commingled skeletal remains from the Newton Plantation, Barbados

Primary Author: Cameron Troyer

Additional Authors: Kris Shuler;Toni Lee;Anna Buckingham;

Department/Program: Sociology

College: College of Liberal Arts

Abstract: Large samples of fragmentary and commingled skeletal remains present unique challenges in bioarchaeology. We examined non-repeating landmarks to assess Minimum Number of Elements (MNE) for humeri and femora from a highly disturbed area of Newton Plantation, Barbados. After sorting and refitting adult humeri and femora, we assessed 15 and 13 possible landmarks, respectively. Only fragments that could be sided with at least one (>50 percent) observable landmark present were counted. Humeri included Number of Identified Specimens (NISP or fragments) of 100 with 315 non-repeating landmarks. Femora NISP=93 with 239 non-repeating landmarks. Completeness (preservation) scores were low for humeri (left 32.8 percent; right 17 percent) and femora (left 19 percent; right 20 percent). Fragmentation scores further showed discrepancies in left (27.3 percent) and right (7.07 percent) humeri but greater similarities for left (11.7 percent) and right (9.1percent) femora. While the highest MNE was seen in the distal shaft of humeri, the left side (n=18) fits observations from other landmarks more closely than the right (n=37). Conversely, femora showed more similarity between sides with (n= 21) left and (n=29) right. The traditional approach was attempted but was problematic due to fragmentation and inability to accurately differentiate overlapping segments. Grouping sides of each element together exaggerated the calculated MNI, portions preserved, NISP, portions defined, and fragmentation index. The specimen-by-specimen entry from the Landmark method is more practical and approachable in a highly fragmented commingled and taphonomic context.

Title: Potential activity of several dusts against litter beetles (*Alphitobius diaperinus*)

Primary Author: Carla Guardado Martinez

Additional Authors: Arthur Appel;Teresa Dormitorio;Ruediger Hauck;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: *Alphitobius diaperinus*, colloquially known as litter beetles, are the predominant insect species found in poultry houses, serving as carriers and reservoirs for pathogens. Conventional insecticide use is limited due to health risks and resistance. This study examined the impact of different dust treatments on the survival and behavior of larvae and adult litter beetles, as potential alternatives to traditional insecticides. Ten larvae or adult beetles were distributed into plastic cups (5 1/2 oz). Dusts were tested by applying 2.5 mL dosages of each dust treatment to the experimental cups. For each dust, six replicates, i. e. six cups, were tested. To ensure even distribution of dust, the cups were sealed and gently shaken. Furthermore, a control group of six cups that were not treated was included. Observations were conducted every 8 hours for 72 hours, counting dead beetles and noting any unusual behavior. Median lethal time (LT50) was calculated if applicable using probit analysis. Larvae were killed by zeolite clay, talc, 85%%20diatomaceous earth, morrocon rhassoul clay, and silicon dioxide insecticide. The LT50 of these dusts was between 24 and 72 hrs. Some beetles were killed when zeolite clay powder was used. Some larvae were killed as well when kaolin clay and boric acid were tested with an LT50 between 40 and 72 hrs. When beetles were tested with 85%%20diatomaceous earth, boric acid, and powdered morrocon rhassoul clay, few were killed with an LT50 between 32 and 72 hrs. Bentonite clay, biochar, ground gypsum, and walnut powder exhibited no activity against either. Similarly, talc powder showed no effect on the beetles, and kaolin clay had no impact on the larvae. The experiments showed that various dust treatments affected beetle activity throughout the observation period. Some treatments reduce activity, while others discourage it. These results indicate the potential of dust treatments for beetle infestation control, advancing eco-friendly pest management.

Title: Bridging the gap: Enhancing science education and promoting environmental sustainability in Alabama's schools and communities through equitable and relevant learning experiences.

Primary Author: Carly Cummings

Additional Authors: Soledad Peresin;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The state of Alabama has a history of racial injustice and inadequate educational performance, particularly in the field of science education. Segregation and unequal resources have persisted in the state's education system, leading to disparities in educational achievement. Specifically, minority populations concentrated in the Black Belt region face significant challenges in science proficiency. The Black Belt region hosts Alabama's forest industry, making the region reliant on environmental science proficiency to ensure economic productivity and sustainability. The aim of this study is to examine the inequities in science education within Alabama, propose solutions to enhance science proficiency and promote the forest industry to secondary students. Previous research suggests that students learn best through relevant hands-on learning material and community involvement. With the majority of Alabama being classified as woodlands, and the largest concentration of forests existing in the Black Belt, learning material involving forest products is relatable and stimulating to student learning. To this end, our work focuses on the development and implementation of a hands-on lesson on the use of forest products to remediate contaminated aquatic systems in secondary science classrooms. Pre- and post-assessment surveys were employed to measure the effectiveness of the lesson on increasing science proficiency and interest in the field of forestry. Additionally, a free community event on sustainability was held for the Auburn-Opelika community. Surveys were conducted to measure the effectiveness of the event in supporting participants' science proficiency and interest in environmental science-related fields. The results of this study have shown positive improvements in environmental awareness, science literacy, and interest in environmental science-related fields. These findings emphasize the importance of creating equitable and inclusive learning environments and engaging communities to bridge the historic educational gap in Alabama.

Title: The gendered impact of per- and polyfluoroalkyl substances (PFAS): A new perspective on PFAS exposure research

Primary Author: Carolina Bell

Additional Authors:

Department/Program: English

College: College of Liberal Arts

Abstract: Per- and polyfluoroalkyl substances (PFAS) are a group of manufactured chemicals that have had increasing safety concerns in recent years. Known as "forever chemicals," PFAS do not break down in the environment and can bioaccumulate in wildlife and humans. Of the thousands of chemicals, many have already been proven to have detrimental health effects. While research and policy response have been largely concerned with PFAS-contaminated drinking water, there is a lack of research on human dermal exposure to PFAS from consumer products. Despite that PFAS has been shown to impact fertility and sex hormones, products that come in close contact with the body have not yet undergone such research. This research review analyzes the existing research on period products, makeup, breastmilk, and diapers and outlines gaps in knowledge surrounding the dermal uptake of PFAS. The results of this research push for additional research on dermal uptake of PFAS in the vulva and vaginal mucosa. The impact of this research is the previously unexamined gendered impact of PFAS. The findings outline a framework of research, awareness, and advocacy to ensure more equitable practices in the PFAS contamination response.

Title: Kinematic differences between fastballs non-strikes and strikes during division I baseball games.

Primary Author: Caroline Keller

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

Department/Program: School of Kinesiology

College: College of Education

Abstract: In 2022, 8.2% of all Major League Baseball plate appearances resulted in a walk to first base (BB: base on balls). As walks can be detrimental to a pitcher and their team's success, identifying possible causes is important. This study investigated in-game kinematic differences between pitches resulting in a walk, and those resulting in a strikeout (SO). Kinematic data were collected on 77 Division I collegiate baseball pitchers using an 8-camera markerless motion capture system (300 Hz). Ball metric data were recorded for all pitches with a TrackMan Stadium Tracking unit. Seventeen pitchers (1.88 +/- 0.04m; 91.7 +/- 5.7kg) threw both a fastball that resulted in a BB, and a SO (not including swinging strikeouts) in the same game. Nineteen commonly reported kinematic parameters, along with vertical and horizontal plate locations, and ball velocity were compared for BBs and SOs using paired-samples t-tests. Bonferroni corrections were applied to adjust for multiple comparisons (p = .017). T-tests revealed significantly more shoulder horizontal adduction (arm leading the trunk) at maximal external rotation (MER) (3.7 +/- 6.5 vs 1.6 +/- 7.4 degrees; t = 2.689, p = .016), and a more left horizontal plate location (-0.20 +/- 0.31 vs. 0.03 +/- 0.23m; t = 2.391, p = .029) for BBs. Ball velocity was significantly quicker for SOs (40.9 +/- 1.2 vs. 40.7 +/- 1.1m/s; t = 3.248, p = .005). Although kinematics and their variability were comparable for BBs and SOs, plate location dispersion was not. The difference in horizontal plate location suggests that pitchers may change their intended target when the likelihood of a walk is increased. Though this could be a strategy employed to increase the difficulty of being hit for a run (by throwing the ball away from the batter), it ultimately appears to be detrimental to their performance. It may, therefore, be more beneficial to utilize the same target location to increase the chances of throwing a strike.

Title: Validate the prophylactic and therapeutic use of novel natural bioactive “Bromelain” in Lewy body dementia

Primary Author: Caroline Lloyd

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Lewy-body dementia (LBD) is a form of dementia associated with abnormal deposits of the protein alpha-synuclein in the brain. These protein deposits are known as Lewy bodies. The major symptoms of LBD include a decline in thinking ability, as well as cognitive fluctuations, Parkinson’s-like movement symptoms, behavior changes, and sleep disorders. Additionally, autonomic symptoms such as difficulty regulating temperature and blood pressure have been associated with LBD. Approximately 1.6 million Americans suffer from LBD, making it the second most common form of degenerative dementia. Furthermore, the prevalence of this type of dementia is increasing globally. Bromelain is a protease that is naturally sourced from *Ananas comusus* (pineapple). Bromelain is a glycosylated monomeric protein that contains a quaternary structure formed from multiple tertiary protein structures with carbohydrates added to the backbone of the protein. Bromelain has been shown to act proteolytically by reducing beta-amyloid plaques in patients with Alzheimer’s disease, yet no similar research has been done regarding Lewy bodies. Bromelain has also been shown to stimulate the release of brain-derived neurotrophic factor, which participates in neuronal plasticity. Currently, intranasal administration of novel substances (a delivery system that can deliver drugs to the brain by bypassing the blood-brain barrier) has been shown to exert neuroprotective effects. This study will elucidate the neuroprotective effects of Bromelain and validate its prophylactic and therapeutic role in the prevention and treatment of LBD. The expected pharmacodynamic action is that Bromelain will act proteolytically to significantly prevent the building up of the alpha-synuclein deposits and increase memory. Thus, this study will validate and propose the neuroprotective effects of Bromelain that can be used to prevent and counteract neuroinflammation, protein deposition, and neurotoxicity in Lewy body dementia.

Title: Investigation of the tumor promoting characteristics of MSK1 and STK11 genes in canine breast cancer

Primary Author: Caroline Parrish

Additional Authors: Richard Bird;Deepika goyal;

Department/Program: Pathobiology

College: College of Veterinary Medicine

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 STK 11 expressed in mammary cancers of domestic dogs, *Canis lupus familiaris*, were analyzed to find highly conserved sequences for designing an rtPCR 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. 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 canine genome was then analyzed to identify primer pairs also conserved in Homo sapiens that were within protein coding sequence and spanned an intron-exon junction. Once the successful primers were synthesized, they were utilized in an rtPCR reaction to find the targeted sequences. 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 MgSO4 added to each reaction, then changing these amounts based on the results obtained when the bands were observed through non-denaturing agarose gel electrophoresis. The addition of DMSO allowed the primers to be more specific in this binding. Once the results were seen through gel electrophoresis results, the bands were then extracted to be used. The samples were purified from the PCR amplicons before being sent off for Sanger Sequencing. The results will be analyzed by using the Chromas software to look at the flat files of the base pairs. This approach will allow for looking at if the amplicons that were created are what is found in Chromas, as size on gel electrophoresis is not always guaranteed. This approach has produced a highly optimized rtPCR protocol that will allow specific amplification of the target sequences to then be used further for analysis of the tumor-promoting char.

Title: The potential role of Phosphoprotein Enriched in Astrocytes-15 (PEA15) in the regulation of circadian rhythm and metabolic disease.

Primary Author: Carrie Smith

Additional Authors: Natasha Wendy Grabau;Taylor Towns;Emily Brinker;Daniel Kroeger;Robert Judd;Rie Watanabe;Emily Graff;

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. The circadian rhythm controls energy homeostasis through the regulation of enzymes, hormones, and transport systems involved inmetabolism. Disruption of the circadian rhythm contributes to metabolic diseases, specifically obesity and insulin resistance. Recent data from our lab demonstrates that PEA15 loss of function alters metabolic flexibility and promotes obesity. In addition, our lab has shown that rodents fed a high-fat diet (HFD) have increased PEA15 gene expression in the hypothalamus. Because of the connection between circadian rhythm and metabolism, we hypothesize that PEA15 loss of function disrupts circadian rhythm and contributes to metabolic disease. We will test this hypothesis through total RNA isolation followed by cDNA synthesis to be used in PCR on custom-designed Taqman array plates to evaluate relative gene expression in the various tissues from the following treatment groups: chow wild type (WT), chow knockout (KO), HFD WT, and HFD KO. Our current study design will measure changes in the gene expression of 7 keyregulators (Cry1, Cry2, Per1, Per2, Bmal, Clock, NPAS2) of circadian rhythm in the hypothalamus and the peripheral tissues. To evaluate sex as a biological variable, we will perform these studies in both male and female mice. The goal of this upcoming study is to evaluate alterations in the circadian rhythm of the peripheral clock genes in the liver and the central clock genes in the hypothalamus of WT and KO mice on chow and HFD. These results will give insight intoPEA15's role in clock gene expression between different tissues, leading to an understanding of its role in circadian rhythm and metabolic disease.

Title: Analyzing the pharmacological effects of *Withania somnifera* in the treatment of chronic insomnia

Primary Author: Carson Walters

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Sleep quality is a crucial aspect of every individual's health. With the increase in stress and anxiety-induced events in the world today, insomnia has become a primary antagonist of sleep quality. Insomnia currently affects 9% to 20% of the United States population. Insomnia is a neurological disease caused by an increase in the secretion of glucocorticoids from the adrenal cortex causing hyperarousal of the hypothalamus-pituitary-adrenal axis leading to poor quality or quantity of sleep. Chronic insomnia is defined as insomnia lasting more than three months at a frequency of at least three times per week. Current treatments for insomnia include but are not limited to benzodiazepines, orexin receptor antagonists, melatonin supplements, and cognitive behavioral therapy. These therapeutical methods have shown to be effective in their respective way. However, they each have significant adverse effects that can increasingly become worse over time. The current study will elucidate the therapeutic efficacy and pharmacodynamic actions of *Withania somnifera*. This bioactive has been used in the Indian Ayurvedic System of Medicine for centuries for treatment of a vast range of disorders including anxiety, fever, pain management, etc. This natural bioactive contains many adaptogenic properties in the numerous withanolides that are included in the botanical. The primary withanolide is Withaferin-A. This steroidal lactone can pass the blood brain barrier and participate in regulation of the hypothalamus. Therefore, *W. somnifera* can potentially assist in regulating the hyperactivity of the hypothalamus-pituitary-adrenal axis resulting in an increase in sleep quality and quantity. The study will be conducted by evaluating the effects of oral consumption of concentrated *W. somnifera* root extract in female adults diagnosed with chronic insomnia. The proposed results are that *W. somnifera* root extract will dose-dependently decrease cortisol levels and increase GABA levels in the bloodstream over a 60-day period.

Title: The effect of ground reaction force on elbow varus torque

Primary Author: Carter Laccinole

Additional Authors: Ryan Zappa;Benjamin Lerch;Yuki Yanagita;Gretchen Oliver;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Baseball pitching is a full-body movement. A recent study showed that the force generated at the lower body might be associated with elbow injury in professional baseball players. In more recent studies, it was determined that there was no direct correlation between ground reaction force (GRF) and any GRF variables, while some studies showed conflicting results. The study aimed to investigate the relationship between GRF and elbow varus torque (EVT). Data was obtained from The OpenBiomechanics Project. The data included 100 baseball pitchers from the high school level to the professional level (college: 80, high school: 7, independent: 9, MLB: 4). Decomposed peak ground reaction force, vertical (VGRF), anterior/posterior (APGRF), and medial/lateral force (MLGRF), and peak elbow varus torque (PEVT) were included in the analysis. A multiple regression analysis was performed to investigate the relationship between GRF and PEVT. This model predicted PEVT ($F(3,96) = 7.61$, $R2 = 0.17$, $p = 0.001$). There was a significant relationship between PEVT (%BW) and MLGRF (%BW) ($\beta = -0.03$, $p = 0.04$). Additionally, there was a significant relationship between PEVT (%BW) and VGRF (%BW) ($\beta = 0.02$, $p = 0.001$). This indicates that GRF plays a role in affecting a player's PEVT. There was a negative relationship between MLGRF and EVT, indicating that increased MLGRF can reduce PEVT. Conversely, there is a positive relationship between VGRF and PEVT, meaning that an increase in VGRF can elevate PEVT. Although the relationship between GRF and PVET was found, the variance was minimal. A more complex model describing the link between force generated by the lower body and kinematics associated with elbow injuries needs to be established to fully understand the relationship.

Title: Writing Wrongs: Initial adaptation of expressive writing for minoritized students at predominantly white institutions who experience microaggressions

Primary Author: Cassidy Brydon

Additional Authors: Tracy Witte;Sydney Waitz-Kudla;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Racial and ethnic based stressors, such as microaggressions, are pervasive, distressing, and result in lasting negative physical and mental health repercussions for minoritized students at predominantly white institutions (PWIs). Stressors related to racial and ethnic identity compound the universally experienced stressors of higher education for minoritized students at PWIs. Expressive writing may be a widely disseminable scalable intervention fit to address the negative repercussions resulting from microaggressions experienced by minoritized students at PWIs. Expressive writing is not explicitly designed to address the experience of microaggressions in this population. As a result, we utilized the ADAPT-ITT Model to develop Writing Wrongs, a culturally sensitive adaptation of expressive writing. In the current study, we conducted a theatre test of the standardized expressive writing prompt as well as the adapted Writing Wrongs prompt in a sample of 18 minoritized college students enrolled at a PWI. Utilizing a mixed-methods design, we completed the first six phases of the ADAPT-ITT model and found full retention, adequate variability for quantitative measures to inform clinical trial, and broad feedback that the intervention was helpful, appropriate, enjoyable, and necessary. Participants further provided recommendations for future modifications of the intervention. Following the ADAPT-ITT Model, the results from the current study can be used to inform the remaining steps of the model resulting in the development of a finalized adaptation Writing Wrongs, of an evidence-based, widely scalable intervention aimed at addressing microaggressions experienced by minoritized students at PWIs.

Title: Genetically modifying the marine bacterium *Vibrio diazotrophicus* to enable visualization during infection in *Strongylocentrotus purpuratus* larvae.

Primary Author: Catherine Weatherford

Additional Authors: Katherine Buckley;Jake Tatum;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The marine bacterium *Vibrio diazotrophicus* is a gram-negative facultative anaerobe that inhabits both seawater has been isolated from the gastrointestinal tracts of the adult purple sea urchin (*Strongylocentrotus purpuratus*). Sea urchins provide an experimentally-amenable model system in which to study immune responses at single-cell resolution. Previous work has characterized the system-wide larval immune response to exposure to *V. diazotrophicus*. This process includes the rapid activation of the inflammatory cytokine IL-17 as well as immune cell migration to the gut. Preliminary data suggest that *V. diazotrophicus* disrupt the gut epithelial cells and invade the larval blastocoel (body cavity). However, the specific fate of the bacteria during the course of this infection remains uncharacterized. The currently-available techniques for localizing bacteria within the larvae (HCR or in situ hybridization) are costly and time-consuming. For this project, the *V. diazotrophicus* genome will be genetically-engineered through a novel recombineering system introduce the coding sequence of fluorescent proteins to the bacterial genome. Fluorescent markers include Green Fluorescent Protein (GFP) and Red Fluorescent Protein (RFP). Recombinant *V. diazotrophicus* will subsequently be used to infect *S. purpuratus*, and visualized with fluorescent microscopy. GFP can be used to identify live bacteria; however, RFP is resistant to the acid-based degradation that occurs following phagocytosis. Together, these two proteins can be used to follow the fate of the pathogenic *V. diazotrophicus* in the context of *S. purpuratus* infection and will provide a broader understanding of this host: microbe interaction.

Title: Measurement of the antioxidant effect of beverages by using ultrasonic irradiation

Primary Author: Chanju Chung

Additional Authors: Duk K. Kim; Alexandra Jackson;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: The intake of water, either plain water or beverage, is a necessary means of hydration for a healthy human life. A positive health effect from consuming beverages with high antioxidant capacity can lower reactive oxygen species (ROS) level that can cause risky chronic diseases. Ultrasonic irradiation was applied first time to measure the antioxidant effect of beverages. ROS suppression by beverages was measured for fruit-originated juices, brewed beverages, alcoholic beverages, and popular sodas. ROS suppression versus the color darkness unit was drawn on a plot to compare the antioxidant capacity of different beverages. The general trend of ROS suppression from fruit juices is the darker the color of the juice, the more it is with more antioxidant capacity. Wines show a similar trend of higher antioxidant effects with darkness. Green tea is an effective antioxidant beverage whose effect is comparable to coffee. Vitamin C is proven to be a very effective antioxidant. Fruit juices with added vitamin C showed the highest levels of ROS suppression in this study.

Title: Patient preferences for continuous glucose monitoring devices: A discrete choice experiment study from people living with type 2 diabetes

Primary Author: Chih-Ting Lai

Additional Authors: Heather Whitley;Surachat Ngorsuraches;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: This study aims to determine the important attributes of selecting a continuous glucose monitoring (CGM) device for patients with type 2 diabetes (T2D). Seven CGM-specific attributes, including the approach to access data, alarm function, measurement and prediction of blood sugar level, accuracy, calibration frequency, sensor lifespan, and out-of-pocket cost, were identified through a literature review and consultation with five clinical experts. Data were collected from 242 American adults living with T2D who were proficient in English via a cross-sectional, web-based, discrete choice experiment (DCE) survey. A D-efficient design was used to generate DCE choice sets. A multinomial logit model was used to determine the preference weights of CGM attributes. Conditional relative importance was calculated by differentiating each attribute's highest and lowest level of preference weights. After excluding those who failed the validation test, 182 patients were included in the analysis. The preference weights of all attributes, except the measurement and prediction of blood sugar, were statistically significant and in the expected direction. The conditional relative importance of out-of-pocket cost was the highest (1.49), followed by accuracy (0.71), calibration frequency required (0.60), methods to access information (0.19), sensor lifespan (0.10), and alarm function (0.09). In conclusion, the out-of-pocket cost was the most important attribute while the measurement and prediction of blood sugar were not significantly important for patients with T2D when selecting preferred CGM devices.

Title: Prospective deficits of insight capabilities in adults with moderate to severe Cannabis Use Disorder

Primary Author: Chloe Wood

Additional Authors: Richard Macatee;Thomas Preston;Brandon Schermitzler;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Over recent years, the prevalence of cannabis use disorder (CUD) has increased while the rate of individuals seeking treatment has simultaneously decreased. Thus, it is important to identify factors that motivate change. In our prior study, we found evidence that people with CUD who also displayed impaired behavioral insight on a probabilistic choice task had reductions in cannabis-related problem awareness and neurophysiological error-processing compared to the participants with CUD who had intact behavioral insight. The aim of the current project is to replicate these prior findings in a new sample of individuals with CUD. Cannabis users (N=21) with CUD completed a probabilistic choice task where they chose to view pleasant, unpleasant, cannabis, or neutral images. Behavioral choice insight was characterized by the accurate versus inaccurate retroactive self-reported most chosen picture type. Participants also completed an inhibitory control task with simultaneous electroencephalography (EEG) recording as a measure of neurophysiological error-processing along with self-report measures of cannabis use problem awareness and motivation to change. Results showed no significant association between error-related neural processing and insight (<<F>>(1,19)=1.1, <<p>>=.31), though the expected effect of errors vs. correct responses on ERN amplitude was significant (<<F>>(1,19)=27.42, <<p>>=<.001). No significant effects were found when analyzing differences in problem awareness (<<F>>(1,19)=2.21, <<p>>=.15). This suggests that impaired behavioral insight in CUD may not correlate with reductions in problem awareness and error-processing, though analyses will be repeated following the recruitment of the full study (~40 individuals).

Title: Measuring xylem characteristics for drought tolerance in peanuts

Primary Author: Christopher Deveau

Additional Authors: Alvaro Sanz Saez de Jauregui;Sajid Hanif;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Peanuts are commonly cultivated across the world in semi-arid climates and regularly susceptible to droughts and heat stress, causing drastic losses in the production of peanuts. This environment accounts for the exposure of about 65% of peanuts in the United States to extreme abiotic stress, resulting in a significant decrease in yield. Improvements to resistance against abiotic stresses such as droughts is vital for the long-term viability of U.S. peanut production. Xylem characteristics of xylem size affect the overall plant transpiration efficiency and have been identified as possible drought tolerant characteristic. We expect to find smaller xylem on more drought tolerant cultivars, allowing the plant to preserve more water during a drought and provide more stability for the plant during drought conditions. The process of measuring each individual xylem is a vastly slow and inefficient method to collect data on the characteristics of each root sample. In this project we are adapting an existing AI software (Segment Anything) that measures xylem characteristics in peanuts. With this proposal, we grew 5 peanut cultivars in the field under irrigated and drought conditions and took pictures of the roots. Once the pictures were taken, images were acquired with an Olympus Slide View VS200 microscope. Those images were run through CVAT utilizing Segment Anything for semi-automatic measuring of xylems in each picture, allowing a much more efficient and accurate measurement of the root's xylem characteristics to identify optimum drought tolerant characteristics in peanuts.

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;Peter Panizzi;Oladiran Fasina;Scarlett Sumner;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 the therapies for wound healing are needed to alleviate this healthcare concern. Curcumin is a natural hydrophobic compound with anti-infective, anti-inflammatory, antioxidant, and healing properties. Sildenafil citrate is a selective and potent inhibitor of cGMP-specific phosphodiesterase type 5 (PDE-5). Sildenafil citrate is FDA-approved and used as a vascular dilator for the treatment of erectile dysfunction and pulmonary hypertension. Several studies have shown that sildenafil also promotes wound healing due to its ability to sustain the cGMP-enhancing effect of NO release but has poor physiochemical properties. In this study, 3D-printed collagen-chitosan scaffolds incorporated with curcumin and sildenafil citrate have been designed and fabricated via extrusion 3D bioprinter to aid in wound healing. Both collagen and chitosan are biodegradable and biocompatible polymers used clinically as drug delivery matrices. Physiochemical properties, including morphology, rheology, roughness measurement, water retention capacity, and porosity of these lyophilized scaffolds were characterized. Thermal analysis by differential scanning calorimetry (DSC) and mechanical test with a texture analyzer were also performed. A novel analytical high-pressure liquid chromatography (HPLC) method was developed and validated to quantify the co-drug formulations simultaneously. The fabricated scaffolds will be further assessed for release properties and the time course and degree of antimicrobial efficacy. Future in vitro and in vivo studies will determine the effectiveness of wound healing applications and be used to optimize formulations.

Title: Advancing pancreatic cancer therapy: designing a novel delivery system for novel RAS inhibitor

Primary Author: Chung-Hui Huang

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: New target-directed drugs are urgently needed for the treatment of pancreatic cancer as it is the fourth leading cause of cancer mortality. Typically, patients are diagnosed at an advanced stage in which survival is under six months. Activating KRAS mutations are the most common mutation in pancreatic cancer, accounting for over 90% of patients. Previous studies have reported the association between KRAS mutations and the progression of cancer via the RAF/MEK/ERK and PI3K/AKT signaling pathways. KRAS has been the focus of both academic and pharmaceutical scientists to develop small molecule inhibitors. Because of the high-affinity association between RAS and its substrate, GTP, these efforts were unsuccessful until recently when covalent inhibitors have been approved for a specific mutation (G12C) in KRAS. Results in pancreatic cancer patients with this rare mutation have been encouraging. To address the broader array of KRAS mutations, our laboratory has developed ADT-007, a pan-RAS inhibitor with high potency and selectivity to inhibit the growth of pancreatic cancer cells regardless of the RAS mutational allele. However, ADT-007 is a hydrophobic compound, and is rapidly metabolized by glucuronidation in the liver. In this study, we designed and synthesized several ADT-007 nanoparticle delivery formulations and evaluated their physicochemical properties and efficiency. Nanoparticle formulations can provide numerous drug delivery advantages by intravenous injection such as bypassing liver metabolism, providing metabolic stability for ADT-007 so it can reach its target in cancer cells. We hypothesize that an optimized nanoparticle formulation of ADT-007 will enhance bioavailability and antitumor efficacy.

Title: Exploring the effects of religious self-discrepancies on compensatory consumption-based coping

Primary Author: Claire Stovall

Additional Authors: Veena Chattaraman;FNU AL-AMIN;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This study examines the intersection of religion, self-discrepancy, and consumer behavior, focusing on the effects of religious self-discrepancies on compensatory consumption behaviors among Christians and Muslims. Given the significance of Christianity and Islam as two of the world's largest religions, this research aims to explore the nature and impact of four types of religious self-discrepancies (Actual-Ideal-Self, Actual-Ideal-Other, Actual-Ought-Self, and Actual-Ought-Other) and their emotional consequences. Utilizing the Compensatory Consumer Behavior Model, the study investigates how these discrepancies influence coping strategies in the marketplace, including direct resolution, symbolic self-completion, dissociation, escapism, and fluid compensation. The research fills a gap in the existing literature by applying the compensatory consumer behavior model within a religious context, providing insights into the psychological motivations of religious consumers and their coping mechanisms. In order to conduct the research, a criterion sampling approach was used to gather data from 39 Christian and 40 Muslim participants, aged 22 to 35, who are second-generation or later immigrants in the United States. This comparative analysis aims to identify emotional outcomes and compensatory consumption-based strategies utilized by individuals to mitigate religious self-discrepancies, highlighting potential differences between Christian and Muslim coping mechanisms.

Title: Neurophysiological reactivity profiles and their associations with cannabis-related problems in individuals with Cannabis Use Disorder

Primary Author: Clarisse Nacilla

Additional Authors: Richard Macatee;Thomas Preston;Brandon Schermitzler;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Neurobiological models of addiction assert that people with substance use disorders are vulnerable to compulsive drug-seeking behaviors because of increases in incentive salience of drug-related stimuli relative to natural reward stimuli (e.g., food, adventure, romance). Studies assigning individuals with substance use disorders to groups based on their neurophysiological responses to drugs versus other reward stimuli found differences in use severity indicators based on those classifications. The present study aims to be the first to replicate these findings in a sample of individuals with Cannabis Use Disorder (CUD). We hypothesize that individuals exhibiting greater neurophysiological reactions to cannabis-related cues compared to pleasant cues will experience more severe CUD outcomes in comparison to those presenting greater neurophysiological reactions to pleasant cues. Cannabis users ($N=22$) ages 18 to 50 with moderate to severe CUD viewed sets of neutral, pleasant, unpleasant, and cannabis-related images with simultaneous EEG recording. The LPP amplitudes for each picture type were entered into a k-means cluster analysis to assign each individual to a reactivity profile. We compared CUD severity indicators across profiles. K-means cluster analysis assigned 12 individuals to a profile showing higher reactivity to cannabis images relative to pleasant images (C>P) and 10 individuals to a profile showing lower reactivity to cannabis images compared to pleasant images (P>C). A t-test comparing means of the Marijuana Problem Scale between the two profiles showed trend-level differences, such that individuals in the C>P profile ($M=7.25$) reported more cannabis-related problems than individuals in the P>C profile ($M=4.5$, $t(19.22)=1.69$, $p=0.106$). Our results suggest that individuals with higher reactivity to cannabis cues may have more severe cannabis-related problems. Further analyses will be conducted once this study reaches its full sample size (~40 individuals).

Title: Exploring PAGs to create Super-PAG relationships

Primary Author: Cody Nichols

Additional Authors: Zongliang Yue;Qi Li;Wei-Shinn Jeff Ku;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Exploring relationships between pathways, annotated lists, and gene signatures (PAGs) is being used to create new and comprehensive non-redundant super-gene sets. In previous research, it has been proven that PAGs enable researchers to obtain relevant biological information from a different perspective. Expanding upon the foundation of PAGs in creating Super-PAGs can lead to new biological insights, enabling researchers to perform Integrative Gene-set, Network, and Pathway Analysis (GNPA) in a new way. Our team comprised of computer scientists and pharmacy faculty has been using methods of clustering and algorithmic exploration, resulting in the creation of synthetic datasets that will be used to analyze relationships between PAGs. Another relational point between PAGs will be analyzed by deploying Large Language Model(s) (LLMs) to encode relevant information belonging to each PAG and comparing those encodings. Pairing these two analysis methods will lead to the creation of Super-PAGs from PAG-PAG networks, unlocking the ability to perform new analysis techniques on new datasets for researchers.

Title: Standing dual-task balance in healthy adults

Primary Author: Connor Cantrell

Additional Authors: Kristina Neely;

Department/Program: School of Kinesiology

College: College of Education

Abstract: The current work reports preliminary data on a dual-task balance study with mobile electroencephalography (mEEG). we aim to determine if postural sway will increase when the physical and cognitive demands of the task are increased. Previous literature suggests that the maintenance of posture is challenged while completing a cognitive task (i.e., a dual-task situation). Further, dual-task balance is associated with specific brain wave frequencies. Here, we investigate whether we can replicate prior work using a new, affordable, and portable mEEG device. To that end, adults complete two 30s trials in six experimental conditions: vision (full vision, no vision), surface (firm, foam), and task (single, dual). In the dual-task condition, participants will count backwards by three from a set 3-digit number between 200 and 999 with verbal responses recorded. Here we report the results from 6 participants (1 woman), 20-22 years old. The results were consistent with previous literature. Postural sway was greater in the no vision condition compared to the full vision condition, the foam surface condition compared to the firm surface condition, and the dual task condition compared to the single task condition. In addition, we observed an interaction for vision by surface, indicating a greater magnitude in the difference between sway in the firm and foam surfaces in the no vision condition, compared to the difference between the firm and foam surfaces in the full vision condition. The results demonstrate that cognitive load increased as predicted across our experimental conditions. In the next step of this work, we will use spectral analyses to determine if such changes in cognitive load are associated with changes in EEG.

Title: Mitochondrial localization of TDP43 and its role in microglial energy regulation and neurodegeneration

Primary Author: Connor Jiminez

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

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Transactive response DNA binding protein 43 kDa (TDP43) is a highly conserved RNA/DNA-binding protein involved in the repair of DNA and transcriptional regulation. TDP43 maintains the homeostatic regulation between synthesis in the cytoplasm and shuttled into the nucleus for physiological functions. Disruption of this regulation can contribute to the onset of pathogenesis such as Alzheimer's disease and frontal temporal dementia. Furthermore, the role of TDP43 energy regulation in microglial cell activation remains relatively unknown. TDP-43 plays a significant role in cellular energy regulation by forming aggregates in the mitochondria resulting in complex 1 and IV inhibition. The current study tests that TDP43 mitochondrial aggregation results in changes in energy flux towards increased glycolysis. Lipopolysaccharide (LPS) comprises a significant portion of the cell walls in Gram-negative bacteria. It is proficient in inducing an immediate inflammatory reaction by prompting the discharge of numerous inflammatory cytokines in different types of cells. To accomplish this stable expressing microglial cells expressing TDP-43-GFP were created using lenti viral technology. Cells were exposed to LPS for 24 hours. Seahorse respirometer was utilized for measuring oxidative phosphorylation (respiration). Glucose uptake assay was utilized for measuring the glycolysis and lactate levels. Our studies found that LPS induces an increase in mitochondrial localization of TDP43 and a decrease in mitochondrial respiration. We also observed an increase in glucose uptake and glycolysis. These data indicate that activation of microglia induces a shift in the energy flux of microglia cells towards glucose utilization. Second, mitochondrial localization of TDP43 is critically involved in this process. Future work will focus on the inhibition of mitochondrial localization of TDP43 in models of neurodegeneration.

Title: The geospatial literary map of Alabama authors of the 19th and 20th centuries

Primary Author: Corey McDaniels

Additional Authors: Kevien Shelton;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: The connection between literature and its geospatial relevance offers a unique lens on cultures that may otherwise be overlooked. The South, with its rich history of intertwining civil rights, music, and pop culture, continues to influence its residents in profound, yet often intangible, ways. Our project, 'The Literary Map of the 19th and 20th Century Alabama Authors', delves into this concept. Utilizing the Neatline software, this interactive literary map reveals the complex network of Alabama authors across the state's counties. It provides insights into their birthplaces, residences, educational affiliations, and burial sites. Data for constructing this map was sourced from multiple, well-established Alabamian literary archives, with the most notable being 'Alabama Authors of the 19th and 20th Century,' led by Dr. Beverley Rilett (Co-Author). Currently, the map showcases 150 authors, covering over half of Alabama's counties. We are in the process of updating the map to include over 1,000 authors. This extensive dataset, which forms the basis for future updates, will be efficiently organized through Python scripts that employ sorting algorithms and AI-driven deep learning models for improved visualizations. The map serves not only as a repository of the state's literary heritage but also as a dynamic tool for educational and research purposes. We encourage ongoing engagement from individuals passionate about literature, geography, and exploring innovative methods within the digital humanities.

Title: Comparing efficacy of AAV capsid serotypes for the treatment of feline GM1 gangliosidosis

Primary Author: Courtney Garrett

Additional Authors: Douglas Martin;Amanda Gross;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Feline GM1 gangliosidosis is a fatal neurodegenerative disease caused by a deficiency of lysosomal β-galactosidase (β-gal). The feline disease faithfully emulates the pathology of GM1 in humans, making it an ideal model for research. Adeno-associated viral (AAV) gene therapy for GM1 aims to restore β-gal activity and minimize disease progression. Choosing an appropriate AAV serotype is critical for GM1 therapy since the vector must treat neurons to alleviate neurodegeneration. This study compares the effects of AAV serotype on survival and disease progression in GM1 cats following injection into the cerebrospinal fluid via the cisterna magna (CM) using serotypes AAV9 and AAVrh10. Each cohort received 1.5x10^13 vector genomes/kg body weight at 2.2 +/- 0.3 months of age (symptom onset occurs at ~4 months). Fluorogenic enzyme assays were used to assess β-gal enzyme activity in various tissue samples in the CNS and peripheral organs. 7T MRI was used to track neurodegeneration across cohorts. β-gal activity increased in the cerebellum and the spinal cord for both treatment cohorts (untreated animals exhibit little to no β-gal activity in the brain and spinal cord). MRI showed delayed neurodegeneration in both cohorts, which correlated with delayed clinical symptoms such as inability to stand. These symptoms are reached at approximately 8 months in untreated animals, but were delayed by 2 months in both treatment cohorts. Ultimately, untreated GM1 cats (n=9) survived 7.9 +/- 0.3 months, GM1 AAV9 (n=3) cats survived 13.9 +/- 1.9 months, and GM1 AAVrh10 (n=3) cats survived 11.9 + /- 0.9 months. Statistical significance was found between the survival of untreated GM1 cats treated cats in both cohorts (p=0.0089) but there was no statistical significance found between AAV9 and AAVrh10 treated cats (p=0.1966). In this study, CM-injected AAV9 showed superior disease progression delay in feline GM1 compared to AAV-rh10.

Title: Phase change mediated transport in transition metal dichalcogenide-based memristor devices.

Primary Author: Dakotah Kirk

Additional Authors: Marcelo Kuroda;Lu Wang;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: The exploration of nonvolatile resistive switching devices has garnered significant attention, particularly in the context of advancing next-generation flexible memory and neuromorphic computing systems. Recent experiments with memristive devices based on two-dimensional materials, specifically semiconducting Transition Metal Dichalcogenides (TMDs), have focused on the advantages of size scaling. However, the underlying mechanisms of these experiments remain unclear. In this study, we delve into the changes in electronic band structures and transport properties within hybrid heterostructures formed with monolayer TMDs MoSe2/WSe2 and various electrodes (Au, Ag, Al, Pd, and Ti). Utilizing first-principles calculations within Density Functional Theory (DFT) and quantum transport calculations, we consider both pristine 2H and 1T' configurations, as well as various substitution and vacancy defects. Our results suggest that these defects alone cannot account for the observed increase in transport through the semiconducting channel. Instead, the TMD phase transition between the insulating 2H to the conducting 1T' configuration better replicates resistance switching observed in experiments. Defects may be exploited to engineer the energy barrier between the 2H and 1T' phases. This work provides atomistic insights into the switching mechanisms of dichalcogenide (TMD)-based memristors.

Title: Investigating the catalytic effects of industrial byproducts – gypsum and red mud – on bio-oils during the rotary kiln pyrolysis of pine wood chips

Primary Author: Dale Hartmann

Additional Authors: Sushil Adhikari;Tawsif Rahman;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: There is a need for ongoing research towards producing sustainable and alternative transportation fuels to reduce greenhouse gas emissions and meet United Nations climate agreements. The liquefaction of biomass is a plausible solution to meet emission targets by the year 2050 through the thermochemical conversion process of pyrolysis. The pyrolysis of biomass produces bio-oils with organic compounds that can be upgraded into transportation fuel by removing oxygen and other contaminants. This study aims to produce improved bio-oils from pine wood chips by mixing industrial byproducts – gypsum and red mud – as a catalyst with the feedstock before rotary kiln pyrolysis. The catalytic oils and their properties were compared to a reference oil produced from the pyrolysis of the same pine wood feedstock but without a catalyst. Unexpectedly, the non-catalytic oil exhibited an oxygen content of 30.7 wt. % which was lower than the two catalytic oils where gypsum and red mud were used as a catalyst to produce oils with oxygen contents of 35.7 wt. %, and 33.8 wt. %, respectively. The non-catalytic and catalytic oils' liquefaction yields exhibited similar product distributions with oil yields around 10 wt. %. After the oils were produced through pyrolysis they underwent a two-step, mild and severe, upgrading process to remove oxygen via hydrodeoxygenation using a bomb-type reactor. The severe hydrotreatment produced catalytic oils with lower oxygen content than the non-catalytic oil, where the oxygen content exhibited for the gypsum oil was 12.3 wt. %, the red mud oil was 10.8 wt. %, and the non-catalytic oil was 15.9 wt.%. The red mud oil performed the best with upgrading, by producing the highest presence of hydrocarbons and alkanes as well as the lowest presence of phenolic and other oxygenated compounds compared to the gypsum and non-catalytic oils. Both the non-catalytic and catalytic oils exhibited a high abundance of phenolic compounds present in the oils.

Title: Humanizing nanobody-based ARC platform for cancer immunotherapy

Primary Author: Damien Ruiz

Additional Authors: Maninder Sandey;Jonathan Marable;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Biologics such as monoclonal antibodies (mAbs) and fusion proteins have emerged as a promising alternative to conventional cancer treatment options. However, initial biological therapeutics posed an immunological risk to human patients due to their xenogeneic origins. Previously, we have developed a novel canine-specific anti-cancer biologic that combines OX40 agonism and immune checkpoint blockade into a single therapeutic. Our Agonist Redirected Checkpoint (ARC) molecule employed an anti-PD-1 nanobody (Nbs) which binds and blocks the PD1 co-inhibitory T-cell receptor and the extracellular domain (ECD) of canine OX40L to stimulate the OX40 receptor. An isoleucine zipper (ILZ) domain was used to facilitate trimerization of OX40L. The canine ARC molecule successfully disrupted the PD-1/PD-L1 axis and initiated signal transduction of the NF-kB pathway via the OX40 receptor. Together, these lead to an enhanced anti-tumor immune response through T-cell expansion, survival, and effector function. In this study, it was our goal to determine if our canine ARC molecule would retain its biochemical and functional properties following the humanization process. To construct the humanized variant, canine OX40L was replaced with human OX40L, ILZ was replaced with a TRAF2 trimerization domain, the canine Fc IgG(d) region was replaced with Fc region of human IgG4, and the camelid Nb was partially humanized. Hu-aPD1-Fc-OX40L demonstrated the ability to bind to its cognate receptors and completely inhibited the binding of human PD-L1 to the PD-1 receptor. Signal transduction of the NF-kB pathway upon OX40 binding was observed. To sum up, the ability of our humanized ARC molecule to abrogate immunosuppressive checkpoint binding and initiate co-stimulatory T-cell signaling was confirmed. The evaluations herein will help us determine if the molecular adaptations made to the original ARC platform are suitable for designing future therapeutics for human cancer patients.

Title: Eco-conscious approach to circuitry: repairability of additively printed circuits utilizing aqueous-based silver nanoparticle ink on polyimide substrates.

Primary Author: Daniel Eseoghene Karakitie

Additional Authors: Pradeep Lall;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: The electronics industry is increasingly prioritizing sustainable practices to minimize its carbon footprint. The emergence of water-based, low-impact waste inks for additive circuits presents an opportunity to reduce or eliminate high-impact waste streams. This shift has given rise to the creation of antennas for widely produced consumer electronics and the development of sensor components for the Internet of Things (IoT). Aerosol jet printing, capable of fabricating 3D structures on a micron scale, has shown versatility, prompting extensive research. This paper delves into the exploration of the performance and interactions of novel water-based materials in realized circuits, an area that remains largely unexplored. The primary focus is on comprehending the repairability of these circuits, a crucial aspect for envisioning their long-term viability and sustainability. The approach involves computer-aided design, additive printing of various metallization layers, and electrically conductive adhesive, followed by performance testing through frequency response analysis and repair of attached components. Through this study, key parameters and techniques have been identified to optimize the attachment process, ensuring the durability and reliability of the realized circuits. The findings contribute to the advancement of the field, fostering the development of eco-friendly electronic solutions with a reduced environmental impact. This research underscores the viability of water-based inks in flexible hybrid electronics and provides insights to enhance their repairability, representing a significant step towards establishing a green and sustainable electronics industry.

Title: Selective extraction of ethylene vinyl alcohol (EVOH) from kcup plastic waste

Primary Author: Daniel Meadows

Additional Authors: Virginia Davis;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Accumulating quantities of plastic waste worldwide has caused a significant need for improved recycling technologies. The inability to reclaim multilayer plastics, primarily in food packaging, in any substantial manner greatly contributes to the increasing plastic waste year to year. Many forms of multilayer plastics are difficult to recycle and reclaim using traditional thermomechanical methods because of the differences amongst the constituent polymers. Recently, chemical recycling has been explored for its use to extract various multilayer polymers. In this work, selective extraction of the barrier polymer ethylene vinyl alcohol (EVOH) from polyolefins in commercial Kcups was completed using dimethyl sulfoxide as the primary selective solvent at 100ºC. The extracted EVOH was characterized using rheological, spectroscopic, and thermal methods and was compared to commercial EVOH grades. It was found that the extracted EVOH was quite similar to the commercial counterparts in terms of spectroscopic and thermal properties. However, it displayed a distinctly different set of rheological properties compared to the commercial EVOH grades. Additional research is needed to determine the origin of these differences. This work shows that EVOH can be effectively extracted from multilayer plastic waste sources with good purity. Future work should study the effects of reintroducing additive packages into the reclaimed EVOH to meet industrial processing requirements.

Title: Analyzing and interpreting the importance of set design choices in modern cinema

Primary Author: Darby Huber

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: A precedent is something that came before. Every furniture piece used in the world today is here due to something that came before it, and therefore created based on a precedent. Whether the precedent was used as inspiration or as an additive or subtractive starting point, replicated there is always a reason and a precedent. When it comes to cinematographic set design, choosing a piece that fits with the historical period of the film and carries additional, often subliminal, plot-related meaning is crucial. While all furniture has precedents, chairs are among the most recognizable, especially when used in film and TV sets. Studies have shown that there is a positive correlation between award-winning set/production design and higher audience scores. How a film is perceived and performed coincides with the ability to make the audience feel as though they're immersed in a world that isn't their own—through excellence in set design, which involves a deep understanding of precedence. Oftentimes the set becomes the silent character in the film or show. The purpose of this research is to analyze iconic set designs through the lens of precedence, considering why the director and set/production designer made the choices they did. This research is grounded in auteur theory, which posits that the director is the auteur (major creative force) of the film output, and the set/production designer is the auteur of the physical (set) output; both auteurs exercise agency over choice of precedent and layers of meaning ascribed to the scenes and the set. This poster will showcase portions of UGRF work output, including a magazine more fully unpacking these concepts.

Title: Production of xenogenic catfish by transplanting blue catfish (*Ictalurus furcatus*) and channel catfish (*I. punctatus*) stem cells into white catfish (*Ameiurus catus*) triploid fry

Primary Author: Darshika Udari Hettiarachchi

Additional Authors: Hamza Dilawar;Misha Soman;Rex Dunham;Ian Butts;Jinhai Wang;Mei Shang;Baofeng Su;Barrett Chambers;Kate Pottle;Jacob Al-Armanazi;Logan Bern;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Xenogenesis has been identified as a potential alternative for hybrid catfish (channel catfish, ♀ × blue catfish, ♂) production. The xenogenesis process can be accomplished by transplanting undifferentiated stem cells derived from a donor diploid fish into a sterile recipient. Xenogenesis for hybrid catfish embryo production has been accomplished using triploid channel catfish as hosts. However, having a host with a short maturation time and smaller body size than channel catfish would be ideal for rapid commercial application. Hence, the present study was conducted to assess the effectiveness of triploid white catfish as a host species to transplant blue (BSCs) and channel catfish stem cells (CSCs) to produce xenogeneic broodstock. Triploid white catfish fry were injected with either BSCs or CSCs labeled with PKH26 dye from 0 to 12 days post-hatch (DPH). At 45 and 90 DPH, growth performance and survival of recipients were evaluated. Colonization of donor cells was evaluated in recipients using PKH26 dye fluorescence. No significant differences in body weight and total length of fry were detected among treatments when sampled at 45 and 90 DPH ($P > 0.05$). Survival increased between 0 to 5.5 DPH when fry were injected with BSCs or CSCs and highest survival was reported between 4.0 to 5.5 DPH. After 5.5 DPH, survival remained high (≥ 81.2%). At both 45 and 90 DPH, cell and cluster area increased for recipients injected from 0 to 5.2 DPH and highest values reported between 4.0 to 5.2 DPH. Thereafter, cell and cluster area declined with no further decrease after 10 DPH. At 45 DPH, the highest percentage of xenogens were detected in BSCs and CSCs treatments for fry injected between 4.0 to 5.0 and 3.0 to 5.0 DPH. At 90 DPH, the greatest number of xenogens were detected from 4.0 to 6.0 DPH in both treatments. The current study demonstrated the suitability of white catfish as a host species when cells were transplanted between 4.0 to 6.0 DPH. These findings allow enhanced efficiency of production of xenogenic catfish carrying gametes of either blue or channel catfish.

Title: The effect of sensor feature inputs on joint angle prediction across diverse actions

Primary Author: David Hollinger

Additional Authors: Michael Zabala;Mark Schall;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Machine learning has shown promise for predicting user intent during continuous activities, such as walking. However, no study has identified top input signals contributing to predicting the user's intended task across a variety of activities. To do so, the algorithm must first show reasonable accuracy for predicting joint angles during simple movement tasks. The objective of this study was to analyze various combinations of input signals that maximize machine learning prediction accuracy for multiple actions while minimizing the required number of sensors to do so. In this study, we trained and evaluated a subject-independent random forest algorithm to predict user intent across several simple movements from various combinations of sensor feature inputs. We hypothesized that prediction accuracy would increase as the number of inputs to the random forest algorithm increased. We also hypothesized that the inclusion of joint angle inputs would improve prediction accuracy. Twenty-eight participants wore motion capture markers and multiple inertial measurement units (IMUs) and performed eight simple movement tasks. A subject-independent Random Forest trained on various combinations of sensor inputs of the participants' first session of simple actions was tested on the second session of simple actions. The root mean squared error (RMSE) of predicting future ankle, knee, and hip angles was performed to determine which sensor combination maximized prediction accuracy. Our results indicated that machine learning prediction accuracy during simple movement tasks is maximized when including joint angle inputs. Contrary to our first hypothesis, machine learning algorithms trained with a single feature input of joint angles resulted in greater prediction accuracy compared to algorithms with multiple feature inputs. We speculate that this outcome resulted from the fact that joint angle estimation during human motion is mainly contingent on the user's prior joint angles.

Title: A case-control study to determine the effects of semester-long reflective journaling on anxiety, sleep quality, physical activity, and diet quality in upper-level baccalaureate nursing students

Primary Author: David Murray

Additional Authors: Drew Fruge;Laura Robinson;Pamela Short;

Department/Program: Nursing

College: College of Nursing

Abstract: In 2022, the United States Surgeon General published the advisory: "Addressing health worker burnout" and called for academic institutions to build resilience and mindfulness into their curricula. Based on this call to action, we sought to determine whether integrating frequent reflective journaling activities into a mental health nursing course currently offered in the Auburn University Bachelor of Science in Nursing program would improve anxiety, sleep, diet quality, and physical activity compared to students in a trailing cohort. Using a case control design, we surveyed students in two courses (effectively juniors and seniors) in August and November of 2023 using validated instruments to measure anxiety (GAD-7), sleep quality (PSQI), physical activity (IPAQ, reported in METs/week), and diet quality (GAT 2.0 with short-Healthy Eating Index [HEI] scoring). Repeated measures ANOVA tested our primary hypotheses, and Spearman correlations explored the relationships between changes in these variables. Forty-five (24 experimental, 21 control) students had matched data from both time points. Median scores (interquartile range) for the sample in August were as follows: GAD-7, 7 (4-12); PSQI, 7 (4-10); METs, 2,085 (1,113-4,128); HEI 53 (43-62). From August to November, median GAD-7 increased to 9 (5-14), ($p=.058$) with no between course differences. No significant interactions or effects of time or course were observed for the other measures. Changes in sleep and anxiety were directly correlated ($\rho=.611$, $p<.001$), but no other significant relationships were observed. These results suggest that reflective journaling activities assigned throughout the semester did not mitigate increases in anxiety in upper-level baccalaureate nursing students. The relationship between sleep quality and anxiety indicates that efforts to improve sleep quality/hygiene may be more beneficial to improving the quality of life in this population.

Title: Genetic analysis of low pathogenic Newcastle disease virus (loNDVs) isolated from wild birds during adaptation to chicken embryos

Primary Author: Deepa Chaudhary

Additional Authors: Ruediger Hauck;Andrea Pietruska;Stephen Pedroza;Saiada Farjana;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Newcastle disease, caused by the Newcastle disease virus (NDV), is economically significant for global poultry production. NDV vaccine strains in wild birds of North America suggest possible transmission between domestic and wild birds. NDV may also be transmitted back from wild birds to chickens. This study investigated the adaptation of NDV strains from aquatic birds to the chicken as host and if that might cause an increase in virulence for chickens. Six isolates of low-pathogenic Newcastle disease virus (loNDV) isolated from wild aquatic birds were passaged in chicken embryos for ten passages. The virulence of the first and the last passage of each isolate was compared by embryo mean death time (EMDT). The whole genomes of the first and tenth passages were sequenced using Illumina sequencing. For each isolate, the genome of passage 1 was assembled de novo, and the reads of passage 10 were aligned with the passage 1 genome for variant calling. Variant functional consequences were predicted using the Ensembl VEP software. Phylogenetic analysis was done to determine evolutionary relationships among isolates.. There were only minor differences between EMDT of the first and tenth passages with no recognizable trend. Sequences covering the full genome sequences >15 kbp in length were obtained from both passages of all six isolates. The mean sequencing depths were between 95 and 480. Preliminary analysis showed that close to 300 single nucleotide polymorphisms (SNPs) and almost 20 INDELs were present in all isolates. Each isolate showed 34 to 71 SNPs and 1 to 6 INDELs. Variants occurred within coding regions of major genes (NP, P, M, F, HN, and L), including upstream of the NP gene. Phylogenetic analysis classified two isolates among Class I NDV and the rest among Class II NDV. This study demonstrates how loNDVs from aquatic birds adapt to chickens as hosts. These identified variants are likely to play a role in the adaptation to chicken embryos, however, there is no indication that the virulence for chickens increased.

Title: Optimization of rtPCR targeting a frameshift mutation in *CEACAM24*

Primary Author: Deepika Goyal

Additional Authors: Richard Bird;Caroline Parrish;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: The glycoprotein encoding genes, *Carcinoembryonic Antigen –Related Cell Adhesion Molecule* (*CEACAM*), are members of the large and highly conserved carcinoembryonic antigen (CEA) gene family. They play important roles in multiple cell pathways including cell adhesion, cell signaling, angiogenesis, inflammation, tumor development, and cancer progression. A recent study has found a relationship between a spontaneously occurring frameshift mutation in canine *CEACAM24* in canine mammary tumors in particular breeds. rtPCR with RNA extracted from canine mammary tumor cell line CMT28 was conducted using three distinct primer sets designed for the canine *CEACAM24* gene, targeting the open reading frame region encompassing the c.247dupG mutation (p.(Val83Glyfs*48)). Subsequently, agarose gel electrophoresis was performed to evaluate the outcome, size, and purity of the PCR products. Due to the presence of numerous transcript variants, a significant background signal was observed with all three primer sets. To mitigate this background noise, adjustments were made to the annealing temperature and magnesium concentration. Additionally, 2 percent DMSO was introduced into the final reaction mix. After multiple rounds of rtPCR with various combinations of magnesium and temperature, successful rtPCR was achieved. In summary, the study successfully optimized rtPCR to amplify the rare *CEACAM24* variant in canine mammary tumors selectively. The results may reveal the presence of the protein-truncating variant associated with a frameshift mutation, offering insight into genetic factors in canine cancer. Further DNA sequencing will be conducted to validate the sequence and confirm the presence of the c.247dupG mutation (p.(Val83Glyfs*48)).

Title: Açaí Botanical Dietary Supplement Extracts Potentiate Anticancer Drugs in Breast Cancer

Primary Author: Destini Thornton

Additional Authors: Jianzhong Shen;Satyanarayana Pondugula;Kabre Heck;Kate Preston;Rinbam Kromtit; Angela I. Calderón

Department/Program: Pharmacal Sciences

College: Harrison College of Pharmacy

Abstract:Açaí (*Euterpe oleracea* Mart.), a fruit indigenous to Central and South America, contains many bioactive compounds linked to potential health benefits. It ranks among the top 40 botanicals in the U.S., prompting a thorough exploration of its pharmacodynamic interactions with established anticancer drugs like methotrexate and tamoxifen. Açaí fruit powder and two botanical dietary supplement capsule formulations, underwent extraction using aqueous, ethanolic, methanolic, and acidic methanolic solvents. Preliminary dose-response experiments were performed on three breast cell lines, MCF-7, MDA-MB-231, and MCF-10A using tamoxifen, methotrexate, and seven açaí extracts, standardized by cyanidin-3-glucoside (C3G) content. While açaí extracts exhibited dose-dependent cytotoxicity, particularly in the MCF-10A normal breast cell line at elevated concentrations (1000 ng/ml C3G), no corresponding toxicity surfaced in the two breast cancer cell lines. Combinatorial screening extended across all three cell lines, examining the effect of anticancer drugs with a human equivalent dose (2.321 ng/ml C3G) concentration of the corresponding açaí extract. Combinations displaying the most statistically significant ($p < 0.05$) distinctions in each comparative dose were selected for a comprehensive combinatorial assay. This was performed through a 7x7 combination matrix of anticancer drug and açaí extract. Data analysis via SynergyFinder+ revealed additive or synergistic effects in the normal breast cell line, MCF-10A. But for the two cancer cell lines, only potentiation was observed. This study strives to unravel the intricate pharmacodynamic interactions between açaí extracts and anticancer drugs. By discerning the safety and efficacy implications of their concomitant use, the research aims to provide an understanding of the potential therapeutic synergy between açaí and established anticancer treatments, contributing valuable insights to the expanding field of cancer therapeutics.

Title: Effect of α′′-Ti martensitic phase formation on plasticity in Ti–Fe–Sn ultrafine eutectic composites

Primary Author: Deva Prasaad Neelakandan

Additional Authors: Dong-Joo Kim;Elham Mirkoohi;Bart Prorok;Wonhyeong Kim;Chanho Lee;

Department/Program: Materials Engineering

College: Samuel Ginn College of Engineering

Abstract: Extensive research has been conducted on Ti–Fe–Sn ultrafine eutectic composites due to theirhigh yield strength, compared to conventional microcrystalline alloys. The unique microstructureof ultrafine eutectic composites, which consists of the ultrafine-grained lamella matrix with theformation of primary dendrites, leads to high strength and desirable plasticity. A lamellar structure isknown for its high strength with limited plasticity, owing to its interface-strengthening effect. Thus,extensive efforts have been conducted to induce the lamellar structure and control the volume fractionof primary dendrites to enhance plasticity by tailoring the compositions. In this study, however,it was found that not only the volume fraction of primary dendrites but also the morphology ofdendrites constitute key factors in inducing excellent ductility. We selected three compositions ofTi–Fe–Sn ultrafine eutectic composites, considering the distinct volume fractions and morphologiesof β-Ti dendrites based on the Ti–Fe–Sn ternary phase diagram. As these compositions approachquasi-peritectic reaction points, the α′′-Ti martensitic phase forms within the primary β-Ti dendritesdue to under-cooling effects. This pre-formation of the α′′-Ti martensitic phase effectively governs thegrowth direction of β-Ti dendrites, resulting in the development of round-shaped primary dendritesduring the quenching process. These microstructural evolutions of β-Ti dendrites, in turn, lead toan improvement in ductility without a significant compromise in strength. Hence, we propose thatfine-tuning the composition to control the primary dendrite morphology can be a highly effectivealloy design strategy, enabling the attainment of greater macroscopic plasticity without the typicalductility and strength trade-off.

Title: IE3 Biology: Truncation Analysis to Determine Functional Regions

Primary Author: Diana Gardner

Additional Authors:

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The research focuses on a Beta Herpesvirus called Murine Cytomegalovirus (MCMV) which relies on Immediate Early Protein 3 (IE3) to regulate lytic replication through transcriptional cascade control. IE3 alters gene expression both in the virus and in the host. Recent research has discovered three isoforms of IE3 (611, 453, 310), rebutting the previously held idea that the full-length 611 isoform was necessary for viral replication. In this study, we are working toward pinpointing the isoform responsible for activating early genes and assessing its impact on the major immediate early promoter (MIEP) using a dual luciferase assay. Our research indicates that the 611 isoform predominantly drives E1 activation, while the 453 isoform acts as a key MIEP repressor. Truncated IE3 variants are being created through Gibson Cloning to identify minimal elements required for transcriptional regulation. Through this research, we aspire to contribute to a deep understanding of IE3 biology and its isoform's ability in transcriptional control.

Title: Analyzing Demographic Preparedness and Resilience to Disaster Types: Insights from Human Mobility Data

Primary Author: Dikshya Panta

Additional Authors: Jake Nelson;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Natural disasters have a negative impact on everyone, and the recovery process sometimes reveals significant social and economic disparities, particularly among some ethnic-racial groups in the United States. Despite the increasing frequency and severity of natural disasters, our understanding of human response, preparation, and resilience remains limited. Traditional resilience models predominantly depend on census data, which, while insightful, misses evolving resilience patterns over time. This study aims to add a more dynamic aspect to resilience models by leveraging human mobility data to address two intertwined objectives: understanding how disaster type influences human mobility patterns before and after a natural disaster and unraveling the relationship between racial and socioeconomic statuses and disaster preparedness and recovery. Mobility is tracked using cell phone data to monitor visits to key points of interest (POIs) associated with preparedness and recovery—grocery stores, pharmacies, gas stations, and home improvement stores—in two locations affected by distinct disasters. The daily number of visits from each Census Block Group (CBG) to these four categories of POIs will be calculated before and after the disaster occurrence. Preparedness will be calculated based on the daily visit percentage change prior to a calamity compared to a baseline "normal" level of mobility. Following a disaster, the time it takes to return to the baseline mobility level for each community will be used as a measure of resilience. With these mobility metrics, this study seeks to discern if mobility patterns vary between disaster events and in relation to the demographic and socio-economic composition of CBGs. Preliminary analysis revealed that pre-event mobility is comparatively low among low-income groups and high among high-income and education groups. Through analyzing near-real-time human mobility during disasters, this study can reveal how different events uniquely affect communities, highlighting key aspects of disaster preparedness.

Title: Machine learning for remote sensing-based estimation of water quality parameters

Primary Author: Dinesh Neupane

Additional Authors: Jingyi Zheng;Stephanie Rogers;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Assessing the characteristics of surface water is critical for managing and improving its quality. While existing in situ measurement methods are precise, they are limited in spatial and temporal coverage and the acquisition cost is high. Incorporating in situ measurements with satellite imagery provides a way to estimate water quality parameters at broader scales and with greater temporal frequency. The application of machine learning shows potential for enhancing the water quality parameter estimation process. Although multiple statistical regression techniques were studied previously to predict water quality parameters, a high-performance machine learning technique that learns higher order statistical relationships between surface reflectance values and water quality parameters is still needed. This research proposes a new technique coupling Sentinel-2 imagery and machine learning to estimate two water quality parameters, chlorophyll-a and turbidity, in three water bodies in Florida (St Johns River, Lake George, and Lake Okeechobee). Surface reflectance values from satellite images were used as a proxy to predict water quality parameters based on in situ datasets obtained from the DBHYDRO database. We evaluated three machine learning models: Support Vector Regression, Random Forest, Boosting, and one DNN model. The initial findings indicate that for turbidity, ensemble learning techniques such as Random Forest (r2 = 0.88, MSE=0.29) and Gradient Boost (r2 = 0.55, MSE = 0.32 (NTU)2) outperformed a feed forward DNN (r2=0.53, MSE=0.34 (NTU)2). However, the Support Vector Regressor (r2=0.26, MSE=0.53 (NTU)2) exhibited the weakest performance. The preliminary results of this study indicate that ensemble methods like Random Forest and Gradient Boosting outperform the feed forward DNN likely because they can capture complex data relationships in a smaller dataset better by combining multiple models.

Title: Variation in nutritive value of whole cottonseed from the Regional Breeding Testing Network

Primary Author: Diva Rigney

Additional Authors: Brandon Smith;Kim Mullenix;Jenny Koebernick;Anna Underwood;Macy Rockwell;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Whole cottonseed serves as a readily accessible, nutritional, and cost-effective supplementary feed for beef cattle. Standard estimates indicate that whole cottonseed contains approximately 52% neutral detergent fiber (NDF), 24% crude protein (CP), and 18% crude fat. For more than 15 years, the Regional Breeders Testing Network (RBTN) has conducted a multi-environment trial (MET) for breeders to evaluate germplasm to include whole cottonseed. The trial presents opportunities to analyze variations among cultivars concerning their nutritional value. Therefore, the purpose of this study was to assess the variability in nutritive value of whole cottonseed from the 2023 RBTN MET. Samples from 20 RBTN cotton varieties were obtained and assayed for NDF, ADF, ADL, and CP. Samples were also subjected for batch culture in vitro true digestibility (IVTD) and crude fat. In our study, NDF (total cell wall content) was less than previously reported book values (45.8% vs. 51.6%). Crude protein was consistent with book values (25.0% vs. 24.4%) and had the lowest degree of variability among the nutrients tested. However, crude fat (the primary energy source in whole cottonseed) in our samples was greater than values previously reported (20.2% vs. 17.5%) and had a high degree of variability. Our findings indicate that the nutritional value of whole cottonseed may differ depending on the variety acquired. This research lays the groundwork for pinpointing the genetic factors responsible for regulating its nutritional value.

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Title: Physical and flow properties of woodchip, bituminous coal, and plastic blend

Primary Author: Edith Laure Yonguep Ngoupeyou

Additional Authors: Sushil Adhikari; Oladiran Fasina;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Co-gasification of coal, plastic, and woody biomass is another approach to reducing the emissions released due to coal utilization and converting municipal solid waste to products of value. However, the physical and chemical attributes of these feedstocks are vastly different. Therefore, the focus of this study is to understand and quantify the properties that are needed to handle and preprocess these mixtures before they enter the throat of the conversion equipment. The physical and flow properties of the individual as well as the 12 blended combinations of the three samples that were passed through 4 mm and retained on 2 mm, as well as those that passed through 2mm and retained on 1mm screens size were measured. In addition, a model was developed to predict the bulk and particle density parameters of the blends with known ratios by deducing the densities of the blends from the measured densities of the individual samples. In general, and for all the samples (blended and individual), the bulk density and particle density of the samples were significantly ($P<0.05$) influenced by screen size, and coal plastic ratio in the blends. Additionally, the sample's flowability was found to fall within very cohesive and easy-flowing regions according to Jenike’s flowability classification for both individual and blended samples, and tended to increase with the coal ratio, (flow index between 1.30 and 8.74). Bituminous coal had the highest angle of wall friction for stainless steel (14.53 degrees), and galvanized steel (23 degrees), and the LDPE Plastic Bag had the highest angle of wall friction (17 degrees) for the TIVAR 88 wall. The blended samples showed better flowability on stainless steel and TIVAR 88 walls compared to the galvanized steel (angle of wall friction between 11.4 and 13 degrees). A strong correlation was observed between the measured and the predicted bulk and particle densities with an average relative error of 1.47% for particle densities and 12.44% for bulk densities respectively.

Title: Analyzing Data-Driven CR3BP Orbit Representations for Immersive Astrodynamics Catalogs

Primary Author: Eirik Mulder

Additional Authors: Davide Guzzetti;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: The highly nonlinear dynamics involved in lunar space exploration and the use of orbits under both earth and moon influence (cislunar) brings new challenges, including the lack of a universal cataloging and identification system for orbits in the earth moon system. This kind of ID system exists for low-altitude orbits in the form of "Keplerian" elements, which use a set of 6 numbers to uniquely identify any 2-body orbit. However, such a system has not been developed yet for 3-body space (earth, moon, and a satellite) due to its inherent complexity. We present an approach to orbit tagging using a neural network based autoencoder, which works to find critical features for dataset compression, and learns to recreate the original data from highly compressed information. We employ the use of 3-dimensional pixels (known as voxels) to represent cislunar orbits, which allows us to employ methods typically reserved for image processing (like the convolutional neural network). We test several kinds of autoencoder structure and demonstrate the feasibility of these techniques with successful tests using 3D circles and 2-body Keplerian orbits. We then utilize the Circular Restricted 3-Body Problem (CR3BP) representation of cislunar space to simplify the 3-body problem, and successfully test an autoencoder on a range of earth-moon orbits. These results show a potential use of machine learning in the astrodynamics field and could help simplify mission design for future missions to the moon and in cislunar space. The ability to create catalogs and uniquely tag and identify orbits could allow for faster mission development, letting engineers quickly browse and filter potential orbits, and might allow for rapid transfer of information through the highly compressed orbit representations.

Title: A Silent Crisis: Addressing the Public Health Epidemic of Chronic Disease in Adult Populations

Primary Author: E'Keema McCray

Additional Authors: Linda Gibson-Young;

Department/Program: Nursing

College: College of Nursing

Abstract: Chronic disease has recently become an epidemic in the United States, affecting about 60 percent of the total population. is affected by one or more chronic disease, The care and maintenance of one or more chronic diseases accounts for about 85 percent of American health care costs. Chronic disease is a condition that greatly affects quality of life and lasts for a year or longer. The significant ones are heart disease, diabetes, and cancer. Chronic diseases are projected to have increase by 99.5 percent in 2050, and comorbidity is expected to increase by 91.2 percent within the same period. Most Americans are affected by one or more chronic diseases, however, minorities are two times more likely to have major chronic diseases. Currently the United States spends around 3.5 of its 4.1 trillion-dollar health care budget on chronic disease care. If left to its own devices, chronic disease in adults could easily dismantle current day American health care. Low socioeconomic status, or SES is a common denominator for chronic disease, and this typically intersects with ethnicity. Multimorbidity, or the presence of two or more major chronic diseases is most prevalent in low-income Black Americans. This information was gathered from scientific journals through systematic search on chronic illness epidemic in the United States, and a thorough search of public health information provided by the Center for Disease Control and Prevention (CDC). The best way to improve chronic disease outlook is to address health disparities by improving health equity. The methods taken to resolve health disparities involve the use of epidemiology and surveillance to gather data and identify the most vulnerable areas, improving environmental laws nationwide such as implementing smokefree air laws, elimination of food deserts, etc., improving access to quality health care in underserved areas, and improving community-related interventions such as self-care management programs for chronic disease.

Title: Confirming the natural bioactive “Echinacea Purpurea Polysaccharide” improves the symptoms of spinocerebellar ataxia.

Primary Author: Elaina Wilkinson

Additional Authors: Suhrud Pathak;Muralikrishnan Dhanasekaran;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Echinacea (a species of coneflower) has been used for its anti-inflammatory and antioxidant properties since the seventeenth century. It contains many bioactives, including polysaccharides, phenolics, and alkylamides, with different medicinal properties. The natural bioactive polysaccharide of *Echinacea purpurea* significantly regenerates the natural killer cell count in mice. The polysaccharides have been shown to significantly increase the production of natural killer cells to exert their pharmacological activity. Spinocerebellar ataxia is a group of rare inherited brain disorders where the patients exhibit tremors, seizures, and ataxia. The current treatment course for this incurable disease is mainly focused on managing the symptoms through medications and non-pharmacological approaches. Based on the existing literature, the polysaccharide of *Echinacea purpurea* has been shown to exhibit neuroprotective effects. Based on the pharmacodynamic actions of the polysaccharide of *Echinacea purpurea* can be used to prevent and treat spinocerebellar ataxia.

Title: The SNAP Cycle and Mental Health: Evidence from Alabama Participants

Primary Author: Elizabeth Byrne

Additional Authors: Joel Cuffey;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: We investigate the relationship between the Supplemental Nutrition Assistance Program (SNAP) benefit cycle and mental health outcomes. SNAP benefits are disbursed on a monthly basis and often leave participants with scarce resources at the end of the month. We seek to understand if SNAP disbursement timing affects daily mental health outcomes throughout the SNAP month. We use survey data collected from the Alabama Gus Schumacher Nutrition Incentive Program (GusNIP). GusNIP is a grant program that was created with the goal of incentivizing SNAP users to purchase more fresh produce. Auburn University's Double Up Food Bucks (DUFB) initiative utilizes GusNIP funding to offer consumer incentives at the point-of-purchase. The survey captures depression symptoms and timing of benefit roll-out relative to the date the survey was taken. We regress mental health scores on where participants fall in their monthly benefit cycle at the time of the survey. We then measure how participation in DUFB can influence depression outcomes by including it as an interaction term. DUFB participation did not have a significant impact on mental health due to low participation rates among our sample. However, we find that depression scores significantly increase around the middle of the SNAP month, and then fall again towards the end of the month. This suggests that SNAP participants tend to be more depressed in the middle of the SNAP cycle compared to the beginning and end of the cycle.

Title: Application of artificial intelligence in NeuroCovid-19

Primary Author: Elizabeth Freeman

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: In the realm of cutting-edge technology, the application of Artificial Intelligence (AI) emerges as an inspiration of hope and innovation in the field of healthcare. This chapter explores the applications of AI's transformative role in the context of Neuro-Covid-19, a critical domain that extends beyond the immediate viral impact globally and pilots the potential of AI in unraveling the intricacies of neurological implications induced by Covid-19. The current chapter also unfolds an overview of the neurological manifestations associated with the virus, emphasizing the need for refined and appropriate diagnostic and therapeutic approaches. Through a comprehensive analysis of recent advancements, the chapter sheds light on the integration of AI tools in decoding complex neurological patterns, aiding in swift and accurate diagnosis. Moreover, the exploration extends to the therapeutic landscape, where AI demonstrates its prowess in personalized treatment plans, optimizing patient outcomes. This data-driven approach not only enhances our understanding of NeuroCovid-19 but also opens avenues for targeted interventions and preventive measures.

Title: Transcriptome profile of the endometrial uterine tissue is affected in heifers with divergent fertility potential

Primary Author: Elizabeth Labresh

Additional Authors: Paul Dyce;Wellison Jarles Da Silva Diniz;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Reproductive performance is critical for the economic viability of cattle operations, yet female infertility remains a challenge for beef producers. Herein, we investigated the molecular basis of heifer fertility by measuring the expression of uterine endometrial genes and their effects on underlying pathways and biological processes. To this end, crossbreed heifers undergoing a breeding program were retrospectively classified as fertile (n = 7) or sub-fertile (n = 5) based on the pregnancy outcomes after artificial insemination or natural breeding. Uterine tissue was collected post-harvest and subjected to total RNA isolation and RNA-sequencing. After data quality control and read mapping, DESeq2 was used to identify differentially expressed genes (DEGs). We identified 219 up and 360 downregulated genes between fertile and sub-fertile groups (p-value ≤ 0.05 and $|Log2FC| > 0.5$). Functional analysis using the InnateDB database identified significant enrichment of KEGG pathways related to G-protein coupled receptor (GPCR) signaling, peptide ligand-binding receptors, GPCR ligand binding, and class A/1 (rhodopsin-like receptors) (p-value ≤ 0.01). Notably, GPCRs play key roles in gonadotropin-releasing hormone (GnRH) secretion and signaling. Underlying DEGs included *CXCL16*, *EDNRB*, and *RGS7* (downregulated), while *CCRL2*, *F2*, *GNAT2*, *GNGT2*, *GRP*, and *LHB* were upregulated in fertile heifers. Moreover, immune-related processes such as regulation of IL-6 and IL-13 production, inflammatory response to antigenic stimuli, and adaptive immune regulation were over-represented. Inflammation and immune response have been previously associated with fertility and reproductive outcomes in cattle. This study sheds light on the differential expression of endometrial genes and regulatory pathways in beef heifers. However, further validation of these gene targets in a large cohort and at different time points is warranted.

Title: Enhancing The Care of Children with Type 1 Diabetes: A Valuable Educational Resource

Primary Author: Ella Leavitt

Additional Authors:

Department/Program: Nursing

College: College of Nursing

Abstract: Type 1 Diabetes is a prevalent disorder commonly diagnosed between ages 4 and 6. Followingdiagnosis, individuals must make lifestyle changes, to include a well-balanced diet, trackingcarbohydrate intake, insulin therapy, and monitoring blood sugar. Diagnosis often happens in thehospital upon a routine blood test prompted by a sudden onset of severe symptoms. During thistime, both patients and their families may encounter stress, which can hinder their ability to retainessential education. To effectively manage lifestyle changes and optimize learning potential, it iscrucial for children and parents to have educational resources that are specifically tailored to theirdevelopmental stage and learning styles. Children in particular benefit from the use of visual aidsthat help to simplify complex information and capture their attention for longer periods of time.The utilization of engaging pictures, vibrant colors, and large font sizes are effective tools toenhance a child's learning experience. The objective of this honors project was to create aneducational pamphlet tailored for children diagnosed with type 1 diabetes to help them betterunderstand their diagnosis and foster a feeling of control. Originally designed to impact childrenand their families in the acute hospital setting, this project has future implications with outreach tocommunity programs, school nurses, and teachers. By providing developmentally appropriate andcaptivating educational materials, children diagnosed with type 1 diabetes can gain confidence tonavigate their condition, while also receiving support from their families and community.

Title: Assessing the Dosage Effect in the AAV Gene Therapy IV Treatment of Feline GM1 Gangliosidosis

Primary Author: Ellie Hundley

Additional Authors: Douglas Martin;Courtney Garrett;Amanda Gross;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: GM1 gangliosidosis is a neurodegenerative disease and a lysosomal storage disorder caused by the lack of B-galactosidase (B-gal). A lack of B-gal leads to the collection of GM1 ganglioside, which leads to defects in the brain and negative effects in peripheral organs. The goal of this study is to determine the effectiveness of adeno-associated (AAV) gene therapy to alleviate symptoms and increase lifespan. Felines were used for this study because of their similarities to human disorders. AAV gene therapy was used for its ability to restore B-gal, which leads to the breakdown of GM1 ganglioside. Treatments were administered intravenously at high dosages and low dosages to GM1 cats to effectively treat the brain as well as the peripheral organs. Clinical assessments were performed, which included neurological exams. Postmortem assessments included vector distribution via qPCR and enzyme distribution via specific activity assays. There was a significant increase of lifespan for felines that received treatment. Additionally, all treated cats had an increase in quality of life, as determined by neurological assessment. The specific activity of B-gal increased in the treated cats. In some cases, the increase in activity was greater in the cohort that received the high-dosage treatment than in the low dosage treatment. However, there was more enzyme activity increase in some peripheral organs in the low dose cohort than in the high dose cohort. This study demonstrated the effectiveness of IV treatment of GM1 gangliosidosis. AAV gene therapy was effective in restoring B-gal in both dosages, however, the two dosage cohorts improved enzyme activity levels differently. The high dose treatment would increase activity more than the low dose. In others, the low dose treatment was more effective to raise activity levels. With two animals in the high dose cohort ongoing, it remains to be determined which dose will prove most effective in ameliorating symptoms and extending lifespan.

Title: The Pain of comparison; social media use and its impacts on college student mental health

Primary Author: Emelia Lewandowski

Additional Authors: Katie Mandeville;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: The current generation of college students share varying amounts of social and virtual interactions, although many have become entrenched in the online world of social media. A 2021 Pew Research Survey identified the popularity of apps such as Instagram (71 percent), Snapchat (65 percent), and TikTok (~50 percent) among young adults. These platforms serve as an outlet to make connections, stay updated with current events, and communicate efficiently. The constant accessibility to such a world presents a risk for adverse effects on student mental health, although students vary in their motivations for being online. Personal levels of Fear of Missing Out (FoMO) may also affect student interactions with social media. The present study explores student FoMO, various motivations for social media use, and the impacts of social media use on the mental health of college students. An online survey was conducted in the fall of 2023 through Qualtrics. Participants included undergraduate psychology students at Auburn University (n=701). We found significant correlations between levels of FoMO and anxiety $r = .320$, depression $r = .270$, and stress $r = .382$. High levels of FoMO also indicated lower levels of subjective happiness $r = -.249$. These results suggest that students who possess a heightened level of FoMO may be inclined to experience poor mental health overall. Instagram, Snapchat, and TikTok are among the most popular platforms mentioned by participants, but they are also the apps that affect users most negatively. Participants frequently reported concerns that these apps waste valuable time and increase detrimental social comparison. Specifically, 57 percent of the sample reported social media negatively affected their perception of their own body. Additionally, almost half of the sample reported attempting to take a break from social media. These results highlight the mental health risks posed by engagement with social media and the negative impact of FoMO on overall well-being.

Title: Hemocompatibility of Branched Amphiphilic Peptide Capsules

Primary Author: Emilee Middleton

Additional Authors: Adriana Avila Flores;Ethan Oesterle;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Branched amphiphilic peptide capsules (BAPCs) are peptide-based nanoparticles composed of two unique peptides developed by our group that have recently shown promise as an mRNA-vaccine delivery platform in mice. BAPCs are an attractive alternative to other nanoparticles, such as lipid nanoparticles, due to their long shelf-life, stability at elevated temperatures, and absence of polyethylene glycol (PEG). Additionally, recent studies suggest that targeted delivery to the lungs may be possible when injected intravenously, which specifically makes understanding the interaction of BAPCs with blood a topic of interest. The objective of this study is to explore the hemocompatibility of BAPCs in whole human blood using three criteria – coagulation, hemolysis, and catalase activity. This was done by exposing whole human blood to three concentrations of BAPCs (40, 80, and 120 µM) for 4 hours before analysis. The hemocompatibility of BAPC-treated samples was compared to non-treated blood as a control, and all measurements were performed in triplicate using blood from a single donor. The results of this study show that BAPCs do not cause a significant increase in any of the three categories compared to untreated blood samples. These results show promising potential for BAPCs as a future mRNA delivery tool in a clinical setting and open the door for future experiments to analyze additional hemocompatibility criteria, reactions across blood types, and how the addition of nucleic acids impacts hemocompatibility.

Title: Beliefs and intentions of U.S. registered dietitians/registered dietitian nutritionists towards providing breastfeeding support to prenatal/postpartum mothers

Primary Author: Emily Bourne

Additional Authors: Ramesh Jeganathan;Chih-hsuan Wang;Geetha Thangiah;Douglas White;Donna Burnett;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Breastmilk is well known as being the preferred form of nutrition for infants due to the many important nutrients it provides. Breastmilk contains nutrients to help aid in the infant's immune system and help to decrease the risk of otitis media, gastrointestinal infections, and respiratory infections. The American Academy of Pediatrics recommends exclusively breastfeeding to about 6 months of age, and continuing breastfeeding to 2 years of age with the addition of complementary foods as appropriate and warranted by mother and baby. Registered Dietitians/Registered Dietitian Nutritionists (RDs/RDNs) are considered the nutrition experts. As so, RDs/RDNs should have an understanding of breastfeeding to be able to promote and support it, according to the Academy of Nutrition and Dietetics. There have been studies conducted to determine RD's/RDN's knowledge and/or attitudes towards breastfeeding as well as the intention of RDs/RDNs regarding breastfeeding with specific parameters. The purpose of this study is to assess the beliefs and intentions of U.S. RDs/RDNs towards providing breastfeeding support to prenatal/postpartum mothers and to better understand the professional development need for RDs/RDNs as it pertains to providing breastfeeding support. The study hypothesizes that the actual intentions (dependent variable) of RDs/RDNs towards providing breastfeeding support to prenatal/postpartum mothers can be accurately predicted by using independent variables (attitude, subjective norm, perceived behavioral control) from the Theory of Planned Behavior (TPB). The study was conducted via survey methodology using the Qualtrics platform. The survey instrument, Breastfeeding Support Beliefs and Intentions Questionnaire is a modification of the online Dietitian Beliefs and Intentions Questionnaire and both are based on the TPB. By conducting this study, we can determine the need for more professional development for RDs/RDNs on breastfeeding support. This in return can help increase breastfeeding rates and successfully meet breastfeeding goals for both mother and baby.

Title: Students’ attitudes about virtual work post-pandemic: how values, confidence, and accountability drive intentions for future virtual work

Primary Author: Emily Findlay

Additional Authors: Sara Driskell;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: An unprecedented time in history is occurring in which remote work is not only a viable option for a career, but, due to the COVID-19 pandemic, a significant portion of the population has experience with it. While younger generations have spent extended portions of their lives interacting with technology and are known as digital natives, missed socially significant milestones and time spent away from friends and loved ones could also contribute towards negative attitudes about the remote workplace. Understanding the attitudes of students who are soon to enter the workforce towards virtual work is vital for moving forwards in re-integrating people into workspaces post-pandemic and could inform how organizations and academic institutions utilize remote work moving forward. This study examines the extent to which students value in-person versus virtual career opportunities, their self-efficacy and confidence in using virtual tools, their motivation for completing in-person and virtual coursework, their perceived accountability in in-person and virtual courses, and their perceived support in virtual and in-person classes. A survey was distributed to an undergraduate participant pool for students in Psychology classes and gathered 599 participants. We found significant mediation among these variables such that online self-efficacy and valuing online work happens because of comfort in online communication, which increases students’ motivations for online work and then predicts satisfaction with online work. This suggests that a key factor in improving self-efficacy for online work and students’ valuing online work is in improving confidence in online communication, which can then cascade into greater motivation and satisfaction. Future interventions for supporting students through online work can highlight communication skills to quickly build student success in these arenas.

Title: A centralized user Interface to display satellite mega-constellations in a gamified system

Primary Author: Emily Kimbrell

Additional Authors:

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Recently, there has been a rise in interest in satellite internet as the world becomes more interconnected than ever before. Satellite-Tycoon (Sat-Tycoon) was developed to understand the dynamics of long-term economic strategies and interactions between satellite internet providers through a gamified model. The biggest challenge in transitioning Sat-Tycoon from a gamified model to a truly playable and engaging game is effectively communicating strategies for resource utilization. User experience testing revealed that a common challenge faced by users was comprehending the impact of a satellite or a group of satellites on overall constellation performance and eventual revenues for players. A proposed solution to this usability challenge is to develop a centralized user interface that intuitively displays significant satellite characteristics such as positioning, orbit design, technology capabilities, and activity status. This integrated display would streamline game mechanics for simpler resource management so players can focus on strategy development. The implementation of a centralized user interface for satellite data will ensure that satellite data is approachable for users of all backgrounds as they engage and develop long-term economic strategies for their satellite internet empire.

Title: Exploring the impact of diet and exercise training on the murine gastrointestinal microbiota.

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 represents all microorganisms residing within an individual's gastrointestinal tract. Alterations in the composition of the microbiota that are detrimental to the host's health represent a state of dysbiosis. Previous research has observed alterations in the microbiota of individuals with obesity compared to their normal-weight counterparts. Furthermore, a high-fat, western-style diet has been observed to induce obesity and alterations in the composition of the microbiome in mice. In addition to diet modification, exercise is another lifestyle intervention utilized in the treatment and management of obesity. Nevertheless, the few studies reporting on the impact of a high-fat diet and exercise training on the murine microbiota have yielded inconsistent results. Therefore, the purpose of our study was to investigate the impact of 12-weeks of moderate treadmill exercise on the microbiota of 4-week-old male mice fed a high-fat-high-sugar diet (HFHS) and/or a regular chow diet. At the conclusion of the study, fecal pellets were collected. DNA extraction, library preparation, and metagenomic analyses were completed. The HFHS significantly altered the murine microbiota at the taxonomic level. For instance, HFHS mice had a greater relative abundance of the phyla Proteobacteria and Deferribacteres compared to their regular diet counterparts. Interestingly, exercise training appeared to attenuate the increase in the relative abundance of Deferribacteres in HFHS mice. Overall, our study provides further evidence that a high-fat, western-style diet alters the composition of the murine microbiome and that exercise may influence some of these changes.

Title: Production of Basil Crops in Biodegradable Horticulture Containers

Primary Author: Emily Stamm

Additional Authors: Mel Hill;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Sustainable practices in the horticulture industry are being investigated due to the amount of waste produced by this multi-billion-dollar industry. The most common topics in sustainability relating to horticultural practices include reducing plastic waste, more efficient water use, and fertilizer runoff, among many others. The recent pandemic gave consumers an opportunity to explore many hobbies, including gardening. As a result, consumers have recognized how much plastic the horticulture industry generates and discards. Generally, plastic horticulture containers are difficult to recycle due to contamination, and the contamination of the containers renders them unusable and unrecyclable which leads to more plastic waste that does not degrade for thousands of years. It is possible to decontaminate plastic horticulture containers but because it is a costly process, many companies do not decontaminate their used plastic horticulture containers. With the obstacles of reusing, recycling, and decontaminating plastic horticulture containers, alternative containers are frequently the focus of scientific research and are being discussed by consumers. For this study, seven container types were evaluated; the performance, degradation, and marketability of the seven containers were analyzed. The seven containers included traditional plastic (control) and six other containers marketed as biodegradable: CowPot, FertilPot, EverEco, Coir, BioPax, Peat. Parameters recorded during the experiment include plant size, container gravimetric differences, container tensile testing, and a consumer opinion. During the greenhouse study, the largest plants were grown in peat and BioPax containers. When tensile strength was evaluated, the BioPax containers had the highest tensile strength during both wet and dry testing at each harvest interval.

Title: Mechanistic investigation of dearomative reductive coupling of heteroarenium salts with alkyl and benzyl halides

Primary Author: Emma Drake

Additional Authors: Rashad Karimov;Agshin Garayev;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Functionalization of heterocycles, particularly involving nitrogen-based skeletons, is of significant interest for pharmaceutical development. This work focuses on the dearomatization of various azaheteroarenes through a blue-light mediated coupling procedure. The reaction occurs via a radical pathway involving reductive coupling of heteroarenium salts and substrates by employing activated zinc as a terminal reductant. Reaction efficiency is enhanced by blue light mediated photoactivation of dimeric reaction intermediates. Good functional group tolerance and yields are observed, along with expansion to unsubstituted pyridines.

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

Primary Author: Emma Hruska

Additional Authors: Gabrielle Schultz;Henry Baker;Miranda Reed;Douglas Martin;Aime Johnson;Arthur Zimmerman;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 and 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 by 2025, 7.2 million people aged 65 and older will have AD, a 7 percent increase from the 6.7 million people affected in 2023. Additionally, almost two-thirds of Americans with AD are women, and evidence suggests that menopause is a clear driver for AD development. During this period, hormone levels change due to lack of estrogen, and previous studies have implicated altered hormone levels as a potential factor for AD development. Thus, we hypothesize that increased hormone levels may contribute to the neuropathology and memory loss associated with AD. To test this, we used an innovative adeno-associated virus (AAV)-mediated anti-hormone antibody treatment in APP/PS1 hemizygous mice, a model of AD. We examined changes in estrous cyclicity, hormone levels, and memory and learning behavior. Here, we report that treatment with anti-hormone antibodies significantly disrupts estrous cyclicity, specifically leading to an increased time spent in estrus, and lowers hormone levels 9 months post-treatment. Additionally, treated APP/PS1 hemizygous 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 hormone levels, but also restore learning and memory performance during STFP.

Title: Regulation of reproductive hormones to prevent cognitive decline of alzheimer's disease

Primary Author: Emma Redmon

Additional Authors: Miranda Reed;Douglas Martin;Benson Akingbemi;Aime Johnson;Henry Baker;Arthur Zimmerman;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Alzheimer's disease (AD) affects a large percentage of our world's population, with women having twice the incidence of the disease as men. Hormonal differences observed in aging men and women are a likely culprit for the difference in the prevalence of AD among the two groups, as dysregulation of gonadotropic hormones during menopause is a risk factor for dementias. For example, luteinizing hormone (LH) levels increase 4-fold in postmenopausal women, and the effects of this significant increase are relatively understudied compared to other hormonal changes, such as the decrease in estrogen after menopause. Here, we test the hypothesis that downregulation of reproductive hormones can restore the memory deficits and AD-related pathology observed in the transgenic APP/PS1 mouse model of AD. Hormone levels were downregulated from 3.0-11.6 fold using a novel adeno-associated virus (AAV) vector to express anti-hormone antibodies. Working and spatial reference memory were assessed using the y-maze spontaneous alternation test and Morris water maze. Other behavioral measures included open field and elevated plus maze to test for changes in movement and anxiety. We also determined whether downregulation of reproductive hormones could decrease beta-amyloid levels and tau phosphorylation using western blot, immunohistochemistry, and ELISA assays. This project will help address the gender disparity observed in AD and help determine whether restoration of reproductive hormone imbalances can prevent dementia in post-menopausal women.

Title: Mitochondrial capacity in two mimidae species: A migratory and non-migratory comparison

Primary Author: Emma Rhodes

Additional Authors: Geoffrey Hill;Wendy Hood;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Although mitochondria produce 90 percent of the energy that fuels migration, their role in the evolution of life histories that include migration is essentially unstudied. We collected 11 Gray Catbirds (*Dumetella carolinesis*, GRCA), which are migratory, and 10 Northern Mockingbirds (*Mimus polyglottos*, NOMO), which are non-migratory, in Coastal Alabama during fall migration. Our goal was to investigate mitochondrial capacity and physiology of both a migratory and non-migratory species from the same avian family. Because they are migratory, we predicted that GRCA would have higher maximum mitochondrial respiration (state 3), basal respiration (state 4), respiratory control ratio (RCR) (state 3/state 4), and mitochondrial density compared to NOMO. We found no significant differences in state 3, state 4, or RCR data between the two groups. Additionally, while not significant, the NOMO respiration data trended higher overall than GRCA. GRCA had higher mitochondrial density than NOMO although this was not significant ($p = 0.07$) until fat score was included in the linear model ($p = 0.05$). Our study demonstrates that variable life history traits may determine mitochondrial capacity other than migration. While NOMO are non-migratory, they are exceptionally active birds, engaging in flapping flight throughout the day.

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Title: Characterization of acoustic pressure waveforms in Rijke tubes with an internal heat source and variable temperature distributions

Primary Author: Emma Signor

Additional Authors: Joseph Majdalani;Cody Shelton;

Department/Program: Aerospace Engineering

College: Samuel Ginn College of Engineering

Abstract: In this work, an asymptotic expansion technique is paired with a naturally occurring small perturbation parameter that arises within the framework of a one-dimensional tube with an open-open endpoint configuration and spatially varying heat source. Integrating the resulting equations with a spectral collocation eigensolver, accurate predictions of acoustic pressure mode shapes and frequencies are achieved across a broad parametric spectrum. Our analysis encompasses variations in the temperature gain across the heat source, the heat source length and location, and the overall thermal profile, in a manner to emulate diverse flow heating configurations that are characteristic of Rijke tubes. Specifically, this investigation begins by considering three piecewise representations of the heat source by juxtaposing constant-constant temperatures before and after a heating element whose temperature is prescribed locally using three analytical functions: linear, exponential, and power-law profiles. This is followed by a logistic distribution that can be globally applied to provide a uniformly valid, continuous, and differentiable thermal profile spanning the entire tube, including the heat source element. Our mathematical procedure relies on Green's functions and an integral formulation that enables us to extract all acoustic frequencies analytically in closed form. These frequencies are found to exhibit a monotonic increase with successive increments in temperature gains, reductions in heat source lengths, retraction of the heat source, and smoothing of the temperature gain across the heat source. Similarly, pressure mode shapes are found to display blunter and often linear variations for higher temperature gains, longer heat sources, and leftward displacements of the heat source towards the inlet.

Title: Endohyphal bacteria in oomycetes

Primary Author: Emma Wingfield

Additional Authors: Laura Rodriguez;Zachary Noel;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Oomycetes are well-known, extremely destructive organisms with varied lifestyles including saprobes, animal pathogens, and plant pathogens. While not true fungi, oomycetes are similar in morphology and lifestyle. It is known that several species of true fungi host bacteria in their hyphae which aid them in many functions, especially virulence against plants. Due to similarities with true fungi, it is hypothesized that oomycetes can also host bacteria in their hyphae. So far, no one has discovered any endohyphal bacteria in these organisms. If we can find these bacteria, identify them, and analyze them, we can better understand how bacteria contribute to oomycete lifestyles and virulence. Utilizing a library of oomycete isolates obtained from Alabama cotton seedlings, we extracted genomic DNA from pure oomycete cultures and attempted to amplify 16S ribosomal DNA using the primers 8F and 1492R. These primers target a region that should be specific to bacteria. We have grown over 80 oomycete cultures and have screened around 40. We have used as many distinct species as possible to have a greater variety of results and a greater chance of discovery. So far, we have not amplified and sequenced 16S genes from oomycetes we believe to be endohyphal. However, if amplification is successful, 16S genes will be Sanger sequenced and used in a BLASTn search against the nucleotide database to determine if they match already known endohyphal bacteria from true fungi.

Title: Isolation and Identification of Lecanosticta acicola and other foliar pathogens associated with Brown Spot Needle Blight

Primary Author: Emmanuel Nyarko

Additional Authors: Annakay Abrahams;Lori Eckhardt;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Loblolly pine stands as the predominant pine species within Alabama, owing to its rapid growth rate, rendering it highly favored for cultivation across diverse habitats ranging from moist flood plains to drier upland slopes. Valued for its versatile wood applications in lumber and construction, it is economically important in the southeastern U.S. However, in recent years, the species has encountered challenges posed by brown spot needle blight (BSNB) caused by the fungus Lecanosticta acicola. BSNB impacts loblolly pine trees by inducing brown or yellow discoloration on their needles. Affected needles may shed 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 aims to identify foliar pathogens that are present on the needles throughout the sporulation period (March to November) and assess the susceptibility of different loblolly pine families to Lecanosticta acicola. We collected needle samples from research plots in Cullman and Washington County, Alabama. Needle samples have been collected from 560 trees and processed. Fungi associated with Brown Spot Needle Blight were uncovered and identified by morphological means. Sporulation chamber experiments were carried out to enable us to determine the fungi directly found on the needles. From the plating of needles, the genera of fungi that have been recovered include Pestalotiopsis, L. acicola, Cladosporium, Epicoccum, Bispora, Trichoderma, Alternaria, Monilinia, Hendersonia, and Ceratosporium. Pestalotiopsis has the highest occurrence among the list of fungi recovered. The fungal genera recovered from the Sporulation Chamber experiments were Hendersonia, Pestalotiopsis, L. acicola, Trichoderma, Merispora, and Aspergillus. Similarly, Pestalotiopsis had the highest occurrence in the results.

Title: Nutrient leaching from a coarse textured soil treated with biochar

Primary Author: Erick David Gutierrez Benites

Additional Authors: Emily Stamm;Sushil Adhikari;Paul Bartley;Andre Luiz Biscaia Ribeiro da Silva;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Biochar, a recognized soil amendment in agriculture, is reported to reduce nutrient leaching. However, the impact varies among products due to biochar properties influenced by biomass source and fabrication process. This study assessed nutrient leaching in a loamy sand soil treated with eleven biochar products at 5% and 10% rates. Control groups included pure soil (positive) and unfertilized soil (negative). Soil-biochar mixtures were packed into PVC columns (average bulk density: 1.51 g cm^-3). Fertilization occurred four times, on a weekly basis, with 10-10-10 and 7-0-7 fertilizers. Leaching events, involving 210 mL of tap water, followed each fertilization. Leachate samples were analyzed for total nitrogen, phosphorus, and electrical conductivity (EC). Leachate samples from biochar-amended columns exhibited EC values similar to the positive control. The EC of leachates significantly decreased over time, reaching its lowest point at the third leaching event, and remained consistent with the fourth. Wakefield, Persist Micronized, and Pure Coconut biochar at 10% significantly reduced nitrogen leaching. Arti and Pure Coconut biochar at both 5% and 10%, and Persist Micronized biochar at 10%, demonstrated potential as soluble phosphorus sources.

Title: Alabama community pharmacists' knowledge and perceptions regarding fentanyl test strips: a cross-sectional survey

Primary Author: Erin Blythe

Additional Authors: Karen Pham;Shannon Woods;Asia White;Lindsey Hohmann;

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Fentanyl test strips (FTS) are used to detect fentanyl in drug substances, but Alabama pharmacists' opinions regarding FTS provision are unknown. Thus, the purpose of this study was to assess the knowledge and perceptions of Alabama pharmacists regarding FTS and factors influencing pharmacists' FTS provision intentions. An anonymous cross-sectional survey was distributed via email to Alabama pharmacists employed in community (retail) pharmacies. The survey consisted of multiple-choice questions and 5-point Likert-type scales (1=strongly disagree, 5=strongly agree) informed by the Theory of Planned Behavior. Primary outcome measures included: knowledge; general attitudes; perceived benefits; perceived barriers; self-efficacy; subjective norms; perceived behavioral control; and intention regarding recommending FTS. Outcomes were characterized using descriptive statistics and predictors of FTS recommendation intentions were evaluated using multiple linear regression (alpha=0.05). The majority of respondents (N=131) were female (64%) and Caucasian (92%). No respondents stocked FTS at their pharmacy and knowledge about FTS was low (mean[SD] knowledge score: 58.7%[15.1]). General attitudes (mean[SD] scale score: 3.4[0.5]), perceived benefits (3.7[0.6]), and self-efficacy (3.1[0.8]) were fairly positive, while perceived barriers were above neutral (3.2[0.6]). Subjective norms were positive (3.5[0.6]), but perceived behavioral control over FTS decision-making was low (2.7[0.8]). Intention to recommend FTS was moderately high (3.2[0.7]), with perceived benefits ($\beta=0.342$, $p=0.002$), perceived behavioral control ($\beta=0.133$, $p=0.045$), and self-efficacy ($\beta=0.142$, $p=0.034$) being positive predictors and perceived barriers ($\beta=-0.211$, $p=0.029$) being a negative predictor of intention. In conclusion, Alabama community pharmacists are willing to recommend FTS, but future research should focus on testing strategies to increase perceived behavioral control and overcome perceived barriers.

Title: Elucidating ionic-electronic conduction in a conjugated polymer using spectroelectrochemistry

Primary Author: Erin McCalley

Additional Authors: Christopher Grieco;Caitlyn Clark;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Poly (3,4-ethylenedioxythiophene):Poly (styrenesulfonate) (PEDOT:PSS) is a conjugated polymer capable of mixed ionic-electronic conduction, a property exploited in bioelectronic applications. This conductivity can be modified by the addition of a cosolvent in the solution-casting process, resulting in morphological changes that affect the mobility of charge carriers. Ethylene glycol (EG) is a commonly used cosolvent for PEDOT:PSS capable of increasing its electronic conductivity but can also decrease ionic conductivity due to unclear changes in the polymer morphology. In this work, various concentrations of EG are mixed with PEDOT:PSS to study the balance between ionic and electronic conduction. Spectroelectrochemistry is used to identify the absorption signatures of the charge carriers in PEDOT:PSS films across the visible and near-infrared spectrum (400 – 2300nm) during charging/discharging of the polymer. These signals are then monitored in chronoamperometry measurements to study the kinetics of electrochemical doping as a function of EG concentration. The results reveal how structural changes in PEDOT:PSS impact charging and discharging of the polymer.

Title: Development of a nanoparticle-mediated photoporation system to deliver RNAs into pathogenic fungi

Primary Author: Erin McGraw

Additional Authors: Adriana Avila Flores;Guillaume Laurent;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Reports of serious fungal infections are rapidly increasing as many fungal species, such as highly pathogenic *Candida auris*, are becoming ever more resistant to antifungal drugs. This makes the development of new treatment platforms incredibly important. One exciting alternative is the use of RNA interference (RNAi), which utilizes the cell's own machinery to silence vital genes. RNAi can be initiated by introducing double stranded RNA (dsRNA) or short interfering RNA (siRNA) into the cytosol. However, the fungal cell wall, a highly impermeable carbohydrate armor, presents a significant barrier for RNA delivery. Physical delivery methods, such as photoporation, are a promising solution to this problem as cells are unable to develop resistance against physical phenomena. This work focused on exploring photoporation as a unique physical delivery system for dsRNA and siRNA in fungal cells. Photoporation uses a combination of pulsed laser light and gold nanoparticles (AuNPs) to form transient pores in the cell. When the AuNPs become energetically activated, various photo-chemical and -physical phenomena, such as cavitation and laser-induced breakdown, occur. Initial optimization was done by irradiating solutions of Saccharomyces cerevisiae, AuNPs, and a reporter dye using an 800 nm Ti:Sapphire laser with a 35 fs pulse duration. Optimized conditions of 10min irradiation at 3.6mJ/cm^2 using 4x10^10 50nm AuNPs/mL were used to deliver siRNA targeting EFG-1, a vital cell wall component, into Candida albicans, an opportunistic pathogen. Gene expression was monitored 12 and 24 h post-irradiation. The silencing of this gene disables the synthesis of a vital cell wall component, resulting in cells being unable to repair the cell wall and compromising viability. This is the first work using photoporation in a fungal system, and results of this study pave the way for the potential clinical translation of a photoporation system for fungal infections.

Title: Evaluating Nutrition and Irrigation in a new peach (Prunus persica) orchard.

Primary Author: Erwin Burgos

Additional Authors: Bernardo Chaves-Cordoba;Edgar Vinson;Melba Salazar-Gutierrez;

Department/Program: Horticulture

College: College of Agriculture

Abstract: Concerns about the current fertilization guidelines for peaches have been raised due to reports of increased costs in fertilizers, nitrate leaching, excessive vegetative growth, and lower fruit quality. The current guidelines were established based on data from decades ago, and they advise the use of 148 to 173 kg of Nitrogen per hectare, which sustains peak-level productions but does not account for orchard-specific characteristics, climate, and production goals. Nutrients accumulated by the plants are removed in pruning and thinning, which improves fruit quality and reduces fungal infections. A new peach plantation of 216 plants was established in Clanton, Alabama, to compare the effects of three different fertilizer levels (0, 50, and 100 percent of guideline rates) on growth and photosynthetic characteristics. The chosen cultivars were 'August Prince', 'Fiery Prince', and 'Ruby Prince' on Guardian rootstock, and irrigation was installed on half of the plants to test the benefits of irrigation. Preliminary results indicate that irrigated plants grew significantly faster (in height and diameter) than non-irrigated plants. Irrigated plants had higher photosynthetic assimilation, although the difference was not significant when compared to non-irrigated plants. Assimilation was highest in July, coinciding with exceptional precipitation and warmer temperatures. The 'August Prince' cultivar performed the best overall, followed by 'Fire Prince' and 'Ruby Prince'.

Title: Gas-phase anionic activation of H2O via MoO3- : a combined experimental and computational study

Primary Author: Eslam Fathy Mohamed Abdelazim

Additional Authors: Evangelos Miliordos;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: In this study, molybdenum trioxide anions interact with water molecules in the gas phase to form chemisorbed and physiosorbed anionic complexes. Anion photoelectron spectroscopy (aPES) and ab initio calculations support the activation of water through the reaction $MoO_3^- \;\; H_2O \rightarrow MoO_2(OH)_2^-$, with the physiosorbed $MoO_3(H_2O)^-$ complex observed in the aPES at higher photon energies. The calculated reaction pathway demonstrates that the activation of water by MoO_3^- is exothermic and that the lowest energy conformer of $MoO_2(OH)_2^-$ has the two -OH groups parallel to one another. In addition, the experimental and calculated vertical detachment energies (VDE) values are consistent with one another and support the conclusions laid out in this article.

Title: An Exploratory Analysis of The Differences in Throwing Kinematics Between Baseball and Softball Catchers

Primary Author: Ethan Kohler

Additional Authors: Benjamin Lerch;Gretchen Oliver;Billy Lozowski;Ryan Zappa;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: One of the primary roles of a catcher in baseball (BB) and softball (SB) is to prevent the baserunner from stealing a base. Due to the similarities between sports, the throwing mechanics between these two groups of athletes are thought to be similar. Despite this postulation, no research has substantiated this claim. This study aims to compare the kinematics of catchers throwing down to second base between BB and SB athletes. Ten catchers, 5 BB (17 y [2], 1.84 m [0.07], 85.6 kg [12.8]) and 5 SB (17 y [3], 1.71 [0.04], 70.9 kg [10.5]), were recorded using an electromagnetic motion capture system (240 Hz). Velocity was recorded using a radar gun. Averages for all included variables were calculated for each individual from three throws from home plate to second base. The kinematic variables were assessed at four-time points: foot contact (FC), shoulder maximum external rotation (MER), ball release (BR), and shoulder maximum internal rotation (MIR). Independent samples t-tests were used to compare kinematics between BB and SB athletes (alpha = .05). T-tests revealed that at FC, BB players had less elbow flexion (BB: 90.8 [14.7], SB 121.1 [21.5], p=.032), less shoulder abduction (SA) (BB: 95.9 [9.4], SB: 114.8 [6.3], p=.006), and greater trunk flexion (BB: 54.0 [14.6], SB: 33.0 [8.8], = .025). At BR, SB athletes had greater SA (BB: 84.9 [7.5], SB: 103.7 [7.7], p=.004), less lateral trunk flexion (BB: -35.8 [14.9], SB: -11.7 [5.6], p=.009), and had greater shoulder horizontal abduction (BB: -8.4 [11.3], SB: 7.1 [7.9], p=.036). At MIR, trunk rotation was less in BB players (BB: -46.5 [8.3], SB: -23.6 [17.8], p=.031). The differences observed in several kinematics between BB and SB catchers suggest different strategies are used even though the motions appear similar. Future research is needed to understand the differences in movement patterns between BB and SB catchers using a greater sample size to increase statistical power.

Title: Enabling human pose forecasting in human-Robot Collaboration: Integrating Contextual Information from assembly sequence plans and eye gaze

Primary Author: Fabian Schirmer

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: In the realm of human-robot collaboration for assembly tasks, a significant challenge involves precise forecasting of human poses to enable proactive adjustments by robots, dynamic adaptation of robots, and overall improvement of efficiency and safety in shared human-robot environments. This research introduces a holistic framework for forecasting human poses in collaborative assembly tasks. The conventional Human Pose Forecasting (HPF) is refined by incorporating contextual information from Assembly Sequence Plans (ASP) and Eye Gaze Detection (EGD). ASPs outline assembly steps, providing details on components and tools used for a 3D object location algorithm. EGD tracks human gaze, generating a 3D vector. A multivariate model integrates past human poses with future predictions based on EGD and ASP, ensuring accurate human pose forecasting. The combination of these algorithms enables the anticipation of human poses, thereby facilitating real-time adaptation of the robot's behavior and fostering a more seamless human-robot collaboration. Although this research is in its early and conceptual stage, initial experiments show promising results for implementing human pose forecasting.

Title: Examining the relationship between trait worry and cognitive impairment

Primary Author: Faith Miller

Additional Authors: Rebecca Dunterman;Susan Teubner-Rhodes Earp;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Anxiety disorders are widespread but underdiagnosed among older adults. Elevated anxiety symptoms, like worry, could help predict and prevent age-related cognitive decline. There is insufficient research examining the relationship between anxiety symptoms and cognitive performance. We will use a cross-sectional design to examine how age and worry relate to cognitive performance. We hypothesize that 1) worry and cognitive performance will have an inverted u-shape relationship, showing poorer performance at high and low levels of worry and 2) cognitive performance, but not its relationship with worry, will decline with age. 25 healthy adults younger than 50 years and 25 adults older than 50 years will be recruited from the Auburn-Opelika area through community outreach, an online registry, and the Department of Psychology's SONA platform. Participants with a history of neuropathology will be ineligible. Participants will complete the Penn State Worry Questionnaire to index trait worry and the Montreal Cognitive Assessment to measure cognitive impairment. They will also complete a battery of tasks assessing cognitive reserve, grit, persistence, prospective and retrospective memory, working memory, processing speed, and cognitive flexibility. We will conduct a series of multiple regressions predicting cognitive variables from age, worry, worry-squared, and their interactions. We expect a significant negative effect of age on cognitive scores, such that performance on cognitive assessments decreases with increasing age. We also expect positive worry and negative worry-squared effects. Specifically, individuals with mild-to-moderate anxiety will have improved cognitive functioning compared to those with lower anxiety, as worry can boost cognitive performance. High levels of worry will cause cognitive overload, decreasing cognitive performance, reflecting comorbidity between anxiety and Mild Cognitive Impairment.

Title: Unveiling the Role of Microfluidic Technology in Deciphering Vascular Disease Mechanisms

Primary Author: Farnaz Hemmati

Additional Authors: Panagiotis Mistriotis;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Introduction: Millions of people worldwide suffer from vascular disease, a broad term encompassing various illnesses affecting the blood vessels. The underlying mechanisms of these diseases remain poorly understood, despite advances in medical technology and treatments. Microfluidic devices have the potential to greatly advance our understanding of the underlying mechanisms of vascular disease. Materials and Methods: For investigating the underlying mechanism of vascular disease, for the first time, we developed, tested, and validated an innovative high-throughput microfluidic platform technology that enables long-term culture of single cells in microenvironments of prescribed dimensions. This device integrates photopatterning and imaging tools to create a 3D confining microenvironment for cells. By employing parallel microchannels of fixed Length (200 µm) but varying Width (3-10 µm) and Height (3-10 µm), we could simulate the confinement experienced by cells in the body under condition of vascular disease. Results and Discussion: We showed that there is a significant effect of the physical environment on cellular health. Vertical confinement led to decreased cell proliferation and increased cell death. In addition, we observed the migration of particular molecules—like Anillin—from the cytoplasm to the nucleus when subjected to vertical confinement. Interestingly, comparable findings were observed in in-vivo investigations carried out on the hypertensive rats' aorta, where Anillin translocated from the nucleus to the cytoplasm, in contrast to its stay in the nucleus in healthy rat aortas. The findings from this study demonstrate the potential of microfluidic devices to advance our understanding of the underlying mechanisms of vascular diseases, which can lead to improved diagnostic and therapeutic approaches.

Title: Development of a Mass Timber Construction Curriculum Framework for Construction Management Education: Bridging Theory and Practice with a Mass Timber Prototype

Primary Author: Farnaz Jafari

Additional Authors: Tom Leathem;

Department/Program: Building Science

College: College of Architecture, Design and Construction

Abstract: The construction industry is witnessing a paradigm shift with the advent of mass timber, blending eco-friendliness with modern design. The 2021 International Building Code now endorses Cross-Laminated Timber for buildings up to 18 stories, yet educational programs lag in providing mass timber management training. This study introduces a curriculum framework to embed mass timber knowledge into construction management education, aiming to groom adept future professionals. The proposed curriculum emphasizes hands-on learning via mass timber prototypes, enhancing students' understanding of its structural and ecological features. Such interactive educational techniques have proven effective in similar fields, suggesting potential success in construction management training. The framework aims to deliver comprehensive knowledge on mass timber properties, construction techniques, compliance with building codes, and sustainability. The research methodology combines a literature review, stakeholder interviews, and surveys to identify educational gaps. Curriculum development will be iterative, incorporating stakeholder feedback. The educational impact of mass timber prototypes will be evaluated through pre- and post-tests in pilot programs. Anticipated findings indicate that the curriculum will fill current educational voids, with hands-on experience highlighted as a vital component by stakeholders. The mass timber prototype is expected to improve understanding of material attributes and construction processes. This initiative is poised to enrich sustainable construction education and practice, potentially becoming a standard in construction management programs. By bridging theoretical knowledge and practical skills, the curriculum is designed to equip students for the evolving demands of sustainable construction, emphasizing the need for proactive educational strategies in the construction industry.

Title: Evaluating thermal cycling Impact on flexible in-mold substrates created through direct-write techniques

Primary Author: Fatahi Musa

Additional Authors: Pradeep Lall;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: In-mold electronics (IME) is a technology that combines printed electronics with film insert molding to create electrically functional plastic components. It's used in various sectors like vehicle components, home appliances, and consumer electronics for tailored user interfaces. IME technology offers flexibility and stretchability, allowing devices to maintain functionality even under strain. However, it faces challenges like electrical resistance, which can lead to subpar performance and reliability issues. This study investigates the profound implications of thermal cycling on the performance and reliability of in-mold flexible substrates created through direct-write printing techniques. This study conducts a comprehensive investigation into the fabrication and performance evaluation of flexible substrates for in-mold electronics (IME). It involves printing conductive traces on flexible materials through direct-write technology, attaching passive elements (resistors, capacitors, and inductors) using stretchable electrically conductive adhesives (ECA), and then thermoforming these prepared samples. The performance of these components is analyzed both before and after thermoforming. Additionally, the study rigorously examines the effects of subjecting these thermoformed samples to thermal cycling, with temperatures ranging between -40 degrees C and 85 degrees C, across 500 cycles. The objective is to provide critical insights regarding the adaptability of in-mold flexible substrates to fluctuating thermal environments. This research has significant implications across various sectors, such as automotive electronics, intelligent packaging, and wearable technology, emphasizing the importance of substrate reliability and durability in these applications.

Title: Influence of plant growth promoting rhizobacteria and poultry litter on hay production and forage quality

Primary Author: Felix SATOGNON

Additional Authors: Rishi Prasad;Kim Mullenix;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: The use of plant growth-promoting Rhizobacteria (PGPR) as agricultural amendments to improve crop production has increased in recent years. This study aimed to determine the combined effects of PGPR and poultry litter (PL) on hay production and forage quality. An experiment was conducted on an established Bermudagrass (Cynodon dactylon) and Bahiagrass (Paspalum notatum) field at the Wiregrass Research and Extension Center (WREC) in south Alabama and a Bermudagrass field at the Sand Mountain Research and Extension Center (SMREC) in north Alabama. Treatments consisted of 100%%20PL equating to 269 kg N ha-1 with PGPR at the beginning of the season (1) or after each cutting (2); 50%%20PL with PGPR at the beginning of the season (3) or after each cutting (4); and two controls with 100%%20PL alone (5) or PGPR alone (6). Forage samples were collected every six weeks for a total of four cuttings at WREC and three cuttings at SMREC to determine dry weight biomass, dry matter content, neutral detergent fiber (NDF), acid detergent fiber (ADF), and crude protein (CP). Significant effects were observed for dry-weight biomass regardless of sampling time, grass species, or location. Treatments 1, 2 and 5 significantly produced the highest dry-weight biomass throughout the season regardless of grass species or location. However, the dry-weight biomass response in this experiment was only influenced by PL application. No significant effects on forage quality (dry matter content, NDF, ADF, and CP) was observed across the grass species or location throughout the season. These are the first-season results from ongoing field experiments assessing the impacts of PGPR and PL on hay production and forage quality. It appears that it may take more than a season to see the significant impacts of these combined applications.

Title: Going Green or Green Sheen? Perceived Value, Attitude, and Purchase Intention Toward Apparel Made from Recycled Polyester Fabric.

Primary Author: Tahseen Tawseef

Additional Authors: Amrut Sadachar; FNU AL-AMIN

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: This study investigates consumer perceptions of apparel made from recycled polyester fabric, employing the Value-Attitude-Behavior Theory to understand how consumers' perceived functional, emotional, and social values of such apparel influence their attitudes and purchase intentions. By incorporating the constructive controversy method, the research presents participants with both the advantages and disadvantages that recycling polyester brings to the table, aiming to embody a comprehensive understanding of its impact on consumer decision-making. This balanced approach acknowledges the complexity of sustainable apparel choices, where consumers weigh both environmental benefits and potential drawbacks. In order to conduct the research, quota sampling is used to ensure a diverse representation of age groups, recognizing that age can moderate the relationship between perceived social value and attitude towards such apparel. The study's inclusive design, considering both positive and negative aspects of recycled polyester, provides a holistic view of consumer attitudes towards sustainable apparel, offering valuable insights for manufacturers, retailers, and policymakers aiming to promote environmental sustainability in the textile industry.

Title: ASSESSING THE VALIDITY OF A CORE TEMPERATURE MONITORING TOOL FOR TACTICAL ATHLETES

Primary Author: Frances Neal

Additional Authors: Joellen Sefton;Philip Agostinelli;Matthew Miller;Nicholas Bordonie;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Core temperature information is essential for guiding prevention and treatment measures. It is critical for those working in severe environments, such as firefighters, military and law enforcement. Developing new physiological monitoring tools that are easy to use and provide reliable core temperature information is critical for heat injury prevention. An easily wearable sensor that correctly estimates core temperature could prevent heat injuries and deaths. The current study compared the ThriveHRI sensor/smartwatch to an Equivial LifeMonitor and a rectal thermistor. This study aimed to determine if the ThriveHRI sensor system provides an accurate and precise estimate of core temperature at rest and during physical activity, representing firefighter occupational tasks at elevated temperatures in healthy adults. Twenty-five healthy, physically active adults between the ages of 19–45 years volunteered. Participants completed multiple rounds of deadlifting and treadmill walking in an environmental chamber set to 43.3�C (115�F) and 50 percent relative humidity. Core temperature was monitored continuously via a Datatherm rectal thermometer, Equivital Eq02 LifeMonitor, and a ThriveHRI heat watch. No significant difference in accuracy between devices was found for any condition ($ps >= 0.532$). A significant difference in bias between devices was found for easy walking ($t(21) = 5.55$, $p < 0.001$, $g = 1.01$), deadlift ($t(19) = 3.60$, $p = 0.002$, $g = 0.73$), and treadmill ($t(16) = 2.42$, $p = 0.028$, $g = 0.60$). A significant difference in precision between devices was found for easy walking ($t(21) = 4.23$, $p < 0.001$, $g = 1.21$), but no significant difference in precision between devices was found for deadlift or treadmill ($ps \geq 0.067$). This study demonstrates the agreeability between the Equivital EQ02 LifeMonitor, ThriveHRI sensor, and the rectal thermometer, which remain consistent as core temperature increases and exposure to a heated environment is sustained. The ThriveHRI heat watch system may be an accurate and precise core temperature sensor system for use in the field.

Title: Capacity of diverse Bacillus species to control both oomycete and fungal pathogens

Primary Author: Francesco Moen

Additional Authors: Md Jahangir Alam;Beatrice Severance;Douglas Goodwin;Zachary Noel;Mark Liles;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Fungal and oomycete pathogens cause billions of dollars in crop losses every year. Plant growth-promoting rhizobacteria (PGPR) have been studied as a biological alternative to chemically derived fertilizers and pesticides in agriculture for decades. *Bacillus velezensis* are particularly effective as PGPR strains due to their ability to form endospores and their safety when applied as a crop seed treatment. However, currently available biological agents are either ineffective at preventing diseases in commercial crops or are administered (i.e. sprayed) in ways that diminish potential disease biocontrol. Therefore, there is a need to enhance efficacy of *Bacillus* PGPR strains and to identify strains that produce bioactive metabolites that inhibit the viability of fungal and oomycete pathogens. We screened over 300 spore-forming *Bacillus* sp. from a unique PGPR collection and identified 156 strains that inhibited plant pathogenic oomycete species, while 90 of those could also inhibit select fungal species. *In plantae* assays were conducted to identify *Bacillus* strains that could protect soybean grown in field soil under growth chamber conditions, *B. velezensis* JM199 and JM907 inhibited disease due to the oomycete pathogen *Globisporangium ultimum* and resulted in 56% and 49% greater root biomass relative to the infected control, respectively. Twenty-nine strains of *Bacillus* with anti-fungal and/or anti-oomycete profiles were submitted for genome sequencing to predict biosynthetic gene clusters (BGCs) encoding secondary metabolites. The BGCs identified included lichenysin, fengycin, surfactin, and bacilysin. Current experiments are investigating how these PGPR strains can be enhanced in their biocontrol efficacy, including identifying streptomycin-resistant mutants with increased secondary metabolite expression, and by combining spores with a prebiotic formulation for use as a seed treatment.

Title: Developing Structure-Process-Properties for the 3D printing of Additive free Ti3C2Tx MXene into Microsupercapacitors

Primary Author: Francis Mekunye

Additional Authors: Virginia Davis;Mackenzie Woods;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: We report advancements in the foundational understanding needed to enable the development of 3D printed MXene microsupercapacitors. MXenes are a family of two-dimensional nanomaterials that are particularly known for their exciting electrochemical properties. Typical MXene electrochemical device fabrication techniques include vacuum filtration, spray coating, and screen printing. In recent years, 3D printing has emerged as a promising technique for fabricating MXene devices with precisely controlled architectures. However, there is limited understanding of how to optimize the manufacturability and performance of printed MXene devices. This talk describes key advances in the understanding of structure-process-property relationships for microsupercapacitors fabricated by direct ink writing (DIW) of aqueous additive-free Ti3C2Tx MXene dispersions. In particular, this work describes the effects of sheet size distribution and liquid crystalline alignment on ink rheology, printability, device microstructure, and device performance. It further evaluates the value of advanced rheological methods such as large-amplitude oscillatory shear (LAOS) rheology and three interval thixotropy testing (3ITT) in predicting manufacturability and performance. The results of this research have expanded understanding of the role of liquid crystalline alignment in 3D printing and fills knowledge gaps in relation to how dispersion properties and processing methods affect the performance characteristics of printed materials.

Title: Pregnenolone 16-alpha carbonitrile, an agonist of rodent pregnane X receptor, can impair testosterone biosynthesis in rodent Leydig cells

Primary Author: Frank Wilbanks

Additional Authors: Satyanarayana Pondugula;Jeff Huang;Benson Akingbemi;Julia Salamat;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Leydig cells (LC) in testes produce the male sex hormone testosterone (T). Several foreign compounds are known to disrupt T homeostasis, some of which are known to activate pregnane X receptor (PXR), a ligand-dependent nuclear receptor. This preliminary study sought to determine whether PXR is present in rodent LC and whether pregnenolone 16-alpha carbonitrile (PCN), an agonist of rodent PXR, affects T biosynthesis in the LC. Experiments were conducted in rat primary LC and MA-10 mouse Leydig tumor cells. mRNA and protein expression of PXR were studied in both rat primary LC and MA-10 cells. Rat primary LC were then treated with either saline or PCN for 24 hours, after which the concentration of secreted T was measured using testosterone radioimmunoassay. Western blot analysis was conducted in rat primary LC to study the effect of the PCN treatment on protein expression of the enzymes and proteins involved in T synthesis. RNA-sequencing analysis was performed in MA-10 cells treated with PCN to evaluate the mRNA expression of the genes involved in T synthesis. Results showed that PXR was expressed at the mRNA and protein level in both rat primary LC and MA-10 cells. Additionally, treatment of rat primary LC with PCN resulted in decreased T secretion. PCN treatment also resulted in the decreased expression of proteins and enzymes involved in T synthesis at the protein level in rat primary LC. Downregulation of the genes of the same proteins was seen in the RNA-sequencing results from MA-10 cells. Together, these preliminary results suggest that PCN, an agonist of rodent PXR, can impair T biosynthesis in rodent LC by downregulating the expression of the enzymes/proteins involved in T biosynthesis. Future studies will be directed to demonstrate whether PCN impairs T biosynthesis in rodent LC in a PXR-dependent manner. These results reveal a novel mechanism that expands the current understanding of the interplay between nuclear receptors and endocrine disruption.

Title: Research to examine perception of animal agriculture through altered communication ecosystems

Primary Author: Gabriella Johnson

Additional Authors: Donald Mulvaney;David Martin;Soren Rodning;Jason Sawyer;Savannah Locke;Katie Corbitt;Karen Hiltbrand;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Segments of society are questioning the welfare of animals in production, whether types of meat consumption have a negative impact on personal health, and the environmental sustainability of producing livestock. Because most Americans are three or more generations removed from production agriculture, they have minimal incentive to question misinformation or unsubstantiated statements purported by anti-animal agriculture groups. With growing evidence, it is purported that lack of effective communication will allow continued erosion of ag literacy and social licensure of many aspects of livestock production agriculture. Our communication, leadership, and influence-science research program examines how alternative messaging, social media channels, as well as video construction can be harnessed to more effectively communicate publicly about animal agricultural production to influence perception. Quantitative and qualitative results provide indication toward tribal views by assessing how the public engages in daily posts of information and misinformation about animal agriculture and provide indication of how and where the industry could design meaningful messaging for improved perceptions. Our current and future research plans include examining the use of infographics and perception analysis in altering negative or incorrect perceptions of the beef industry. Further, we look to investigate the sustainability awareness of beef producers. Communicating about science and animal agriculture more effectively to varied public audiences, however, turns out to be difficult. Because the societal contexts surrounding various aspects of issues of concern can vary considerably, communication approaches need to be adapted to reflect the circumstances that prevail. Members of non-ag and ag segments or tribes alike, need animal production information that is factual, scientifically supported as well as emotionally satisfying.

Title: Anti-hormone Treatment Alters Immunohistochemical Hormone Receptor Expression in Various Tissues

Primary Author: Gabrielle Schultz

Additional Authors: Douglas Martin;Aime Johnson;Arthur Zimmerman;Emma Hruska;Malia Walton;Anniston Dodson;Johanna Ehrhardt;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: The hypothalamic-pituitary-gonadal (HPG) axis has long been implicated in neuronal and sensory system development, reproductive function and behavioral changes both in humans and other species. Hormonal dysfunction, typically due to aging (i.e. menopause in women), plays a significant role in the cognitive decline associated with neurodegenerative diseases, namely Alzheimer's disease (AD). Additionally, and more recently, fluctuations in hormone levels have been implicated as a driver of the pathogenesis and cognitive decline associated with other reproductive disorders such as polycystic ovarian syndrome (PCOS). Current therapies for AD target symptoms or manifestations of the disease, but these therapies do not generally slow disease progression and are only administered after diagnosis, which can be 10-15 years after disease onset. As for PCOS, many treatment options come with severe and wide-ranging side effects and may exacerbate infertility. Therefore, there is a critical need for novel therapies that target increased hormone levels, one of the underlying drivers of disease for both AD and PCOS. We hypothesize that development of an anti-hormone antibody treatment would lower hormone levels, and if administered early, could slow or stop AD progression and would reduce both the cognitive decline and infertility associated with PCOS. To study this, we used an innovative adeno-associated virus (AAV)-mediated anti-hormone antibody treatment in CD1 mice to begin testing this alternative approach. Here, we examined changes in hormone receptor expression within various tissues including the brain, ovary and uterus. We report that treatment with anti-hormone antibodies significantly alters hormone receptor expression in all examined tissues. In the future, we will test the efficacy of our anti-hormone therapy in relevant mouse models of both AD and PCOS.

Title: Evaluating *Bacillus velezensis* isolates and culture conditions for inhibition of *Pythium insidiosum*

Primary Author: Georgianne Denzik

Additional Authors: Priscilla Barger;Mark Liles;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: *Pythium insidiosum, Paralagenidium karlingii* and *Lagenidium giganteum* forma *caninum* are oomycete pathogens that cause severe cutaneous and disseminated disease in a wide range of animals and are of particular concern in companion animals. Current treatment protocols include aggressive surgical resection followed by prolonged antifungal and corticosteroid therapies. Even with these treatments, the prognosis is extremely guarded. To provide more targeted therapies against these pathogens, anti-oomycete medications are urgently needed. *Bacillus velezensis* is a ubiquitous, non-pathogenic bacterial species that produces a host of secondary metabolites. Metabolites of rhizosphere-associated *B. velezensis* have been shown to be effective in plant growth promotion and in the control of plant-associated *Pythium* species. To determine if these same isolates have a similar effect on animal pathogenic oomycetes, an established *B. velezensis* library was screened against *Pythium insidiosum* on multiple media types, and zones of inhibition were measured. The results of this pilot study identified that multiple *B. velezensis* isolates were capable of inhibiting *P. insidiosum* growth *in vitro* and indicated the importance of media composition in expression of *B. velezensis* bioactive secondary metabolites that inhibited oomycete growth. These research results support the potential use of *B. velezensis* in the treatment or control of oomycete pathogens in animal systems. Research is ongoing to screen this library against *P. karglingii* and *L. giganteum* forma *caninum*, and to determine the secondary metabolites responsible for oomycete growth inhibition.

Title: Speech intelligibility and phonemic errors in veterans with hearing loss: Effects of age, degree and slope

Primary Author: Grace Dohl

Additional Authors: Cally Watson;Tatum Popwell;Sydney Taylor;Diane Westhoven;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: There are currently a total of approximately 20 million veterans seeking help for health issues in the United States. A significant number of these veterans are exposed to loud occupational noise exposures. This often leads to two main consequences, namely sensorineural hearing loss and tinnitus. This study was completed by performing a retrospective analysis of 64 de-identified veterans with complaints of hearing loss. The first aim of the study was to find a relationship between hearing loss and speech intelligibility. Age, degree and slope of hearing loss were computed in each veteran and linked to their specific speech intelligibility score. The age of each veteran and degree of hearing loss were found to be significant factors in decline of speech intelligibility. It appears that older veterans and veterans with greater degrees of hearing loss are at higher risk for communication impairments. The second aim was to find the relationship between the number and type of speech recognition errors in veterans with hearing loss. Errors were computed in terms of: 1. Place of articulation (location of articulators e.g. teeth, tongue, lips, etc.), 2. Manner of articulation (the degree of constriction throughout the vocal tract) and 3. Vowel change (the tongue height and advancement). More phonemic errors were observed for place of articulation opposed to manner and vowel change. Hearing loss was found to have a greater effect on place errors than manner and vowel change.

Title: Adapting to a changing climate – responding to the 2023 Florida Keys marine heat wave and coral bleaching event

Primary Author: Gretchen Luchauer

Additional Authors: Denise Cole;Kelly Dunning;Makenzie Criswell;Nadi Bowles;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: The Florida Keys Reef Tract is the third largest barrier reef in the world and is the only barrier reef in the contiguous US. Each year about 5 million people visit the Florida Keys which generates $2.4 billion in local revenue and supports the local communities in the Florida Keys, including coral reef diving, snorkeling, and recreational fishing. Corals are known to lose their color, or bleach, when under chronic stress due to long-term heat, cold, low pH, or disease. However, since the 1980s, summer heat driven coral bleaching events have intensified in Florida Keys National Marine Sanctuary (FKNMS). These bleaching events are major contributors to the loss of corals, coral cover and reef structure due to higher water temperatures and longer durations of high-water temperatures. The most severe of these coral bleaching events occurred from June through October 2023. We interviewed 31 people who are directly or indirectly involved in FKNMS ecosystem management from August 2023 to November 2023 and found that the 2023 marine heat wave caused both temporary and long-term changes in FKNMS corals and ecosystem management. This includes development of emergency response protocol, changes in ecosystem monitoring, review and revision of Mission Iconic Reefs management plan, and upcoming reef assessments. Preliminary visits suggest that some coral species have fared better and recovered from bleaching compared to other species, which is important for adapting management plans to climate change. Aside from corals, sea turtles have been particularly affected due to their determination of sex depending on sand temperature. Only female sea turtles are being born in the Florida Keys. Other impacted organisms include dolphins, fish, spiny lobsters, and birds. Effects to these organisms include fish kills, reduced food availability, unusual population migrations. Finally, the 2023 marine heat has increased local climate grief and reduced local tourism.

Title: Investigating the impact of poultry litter application method on phosphorus leaching in agricultural soils using interruption flow technique.

Primary Author: Gurparshad Singh Brar

Additional Authors: Kritika Malhotra;Jasmeet Lamba;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Phosphorus (P) management in agricultural soils is crucial for sustainable crop production, and the application of poultry litter has gained prominence as a nutrient source. This study examines the impact of various poultry litter application methods on phosphorus leaching, employing the interruption flow technique to assess the dynamics of P transport in agricultural soils and groundwater. Therefore, a lab experiment was conducted to determine the effects of subsurface application and surface broadcast application of poultry litter on nutrient losses in leachate. The interruption flow technique allows for real-time monitoring of P movement in response to rainfall events. Rainfall simulation experiments are carried out by using the soil column, carboys, a peristaltic pump, a sealed PVC base cap, and a leachate collection system. The treatments were surface broadcast and subsurface-banded poultry litter at 10 Mg ha^{-1} and an unfertilized control. Results of the rainfall simulations showed that the concentrations of PO_4–P for the subsurface application method of poultry litter are significantly lower than the surface broadcasting method for all three simulations. Moreover, concentrations of PO_4–P from the subsurface application method are slightly higher but similar to the control treatment. Results indicate that for all three simulations, the subsurface application method of poultry litter can greatly reduce the loss of Phosphorus in leachate as compared to the surface broadcast method.

Title: Role of CXCL7 in colon cancer cell proliferation

Primary Author: Hadeel Aldhowayan

Additional Authors: Michael Greene;Elizabeth Lipke;Ramesh Jeganathan;Parker Jones;Ifeoluwa Odeniyi;Lauren Jun;Jannatul Ferdous Nipa;

Department/Program: Nutrition Dietetics and Hospitality

College: College of Human Sciences

Abstract: Chemokine (C-X-C motif) ligand 7 (CXCL7) is a potential biomarker for colorectal cancer (CRC) diagnosis. Here, we examined the role of CXCL7 in colon cancer cell proliferation through enhanced aerobic glycolysis. The effect of CXCL7 on cellular proliferation and glycolytic flux was examined by using human colon cancer (HT-29) cells transfected with CXCL7 or an empty vector as a control. In addition, we treated HT-29 cells with CXCL7 obtained from the conditioned media (CM) from CXCL7-transfected HEK-293T cells or CM from vector-transfected cells. Also, we examined proliferation in 3D-engineered tissues and tumor xenograft growth in nude mice injected with HT29 transfected cells. The proliferation rate in CXCL7-expressing HT-29 cells and HT-29 cells treated with the CXCL7-CM were higher (1.2-fold and 1.8-fold, respectively) compared to controls ($p<0.01$). Consistently, the proliferation rate in CXCL7-expressing HT-29 3D- engineered tissues was significantly enhanced compared to vector-expressing tissues ($p<0.05$). Interestingly, blocking the CXCL7/CXCR2 axis using a CXCL7 neutralizing antibody and a CXCR2 inhibitor abrogated CXCL7-stimulated proliferation. Data from lactate assay, glucose uptake, Seahorse assay, and Western blots confirmed that CXCL7-expressing HT-29 cells and HT-29 cells treated with CXCL7-CM have higher glycolytic capacity and higher glycolytic enzymes' protein expression compared to the controls. In vivo, CXCL7-expressing HT-29 xenograft tumor weight and PCNA protein levels were 100% and 60% greater, respectively, than the control ($p<0.05$). Our study for the first time, showed that CXCL7 stimulates colon cancer cell proliferation and enhances aerobic glycolysis.

Title: Designing a Resilient Future: Establishing a New “Era” of 21st Residential Design

Primary Author: Hadley Lewis

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: As inferred from past interior and architectural styles, form follows function, but what function does the 21st century’s design honor? Past eras include Victorian, Craftsman, and Minimalist. Current residential design requires a new design “era” to cater to society's evolving needs and to protect natural resources. With birth rates declining by 20% over the past 13 years and society’s life expectancy increasing by approx. 2.5 years every decade, the new standard should consider aging in place while utilizing natural resources. Aging in place requires a human-centered design approach: the home’s finish and furniture selections should embrace appropriate materials while the building shell should accommodate end users' progressive needs. As the interior styles cycle through design trends, the building shells will need to maintain a constant foundation by embodying building innovations for aging in place and protect the environment's resources through raw materials, curvilinear forms, ADA-compliant space planning, and technology advancements in lighting, plumbing, and means of transportation. The purpose of this research is to develop and establish guidelines for a new standard for residential design, describing the current/future “era” of design. Just as previous design “eras” relied on the context of the time, this guideline acknowledges aging in place and sustainable choices as the main factors for design in the coming years. By focusing on current building codes, current motivating factors, and previous design era precedents, this work is significant as little work has been done to operationalize the current era of residential design.

Title: Increasing herbicide absorption in doveweed (Murdannia nudiflora) using iron fertilizers

Primary Author: Hailey Rhodes

Additional Authors: Scott McElroy;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Doveweed (Murdannia nudiflora) is a non-grass monocot weed that is difficult to control with herbicides due to its thickened cuticle resulting in poor herbicide absorption. The objective of this study was to evaluate the effects of iron fertilizers and surfactants to improve herbicide activity. The greenhouse study evaluated Ferromec AC (urea and ferrouse sulfate heptahydrate), Ferromec AC with Trimec Southern (2,4-D, dicamba,propionic acid), Sprint 330 (sodium iron DTPA), Sprint 330 with Trimec Southern, Trimec Southern, and Fiesta (iron HEDTA). The field portion of the study consisted of three trials: first with the same treatments as the greenhouse portion, second that consisted of Trimec Southern, Princep (simazine), Blindside (sulfentrazone, metsulfuron), Coastal (imazaquin, prodiamine, simazine), Sceptor T&O (imazaquin), and MSM (metsulfuron) with and without Sprint 330, and third testing MSM with various surfactants including Induce (nonionic surfactant), Dyne-Amic (modified vegetable oil), Kammo Plus (nonionic oil concentrate), MSO (methylated seed oil), Hel-fire (aminated phosphoric and carboxylic acids, sulphurated amides), Adigor (mythyl esters and fatty acids), and Agri-dex (paraffinic oil, polyol fatty acid esters). In the greenhouse study, both iron fertilizers improved control of doveweed, but only with plants producing less than two tillers (<4 weeks old). In field studies, iron fertilizers alone did not control doveweed.. However, Trimec Southern doveweed control increased with both iron fertilizers, and Coastal control increased from 3% to 66% with Sprint 330. Other herbicide to herbicide-iron comparisons had little to no difference.MSM Turf doveweed control was decreased by all surfactants except Kammo Plus and Adigor which had no effect. In conclusion, additives such as surfactants and iron fertilizers may have some benefit to herbicides, but the effect may be herbicide and plant size dependent.

Title: Smart Inventory Management and Quality Assurance System for Ornamental Nurseries

Primary Author: Hamid Syed

Additional Authors: Jeremy Pickens;Tanzeel Rehman;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Efficient inventory management and rigorous quality evaluation play crucial roles for monitoring sales, yield, space utilization, production schedules, and quality enhancements in the ornamental nursery sector. The current method for conducting inventory and quality assessments is through manual plant counting, even when dealing with thousands of plants. The prevailing approach is inefficient, time consuming, labor intensive, potential inaccuracies, and high expenses. Given the continuous decrease in the U.S. farm labor pool, and its expected long-term trend, the implementation of an automated inventory management system is crucial to support sustainable practices on a national and global scale. The core aim of this project is the development and testing of a smart ground-based vision system for automated inventory management and quality evaluation, covering aspects such as canopy architecture, color, uniformity, and homogeneity of ornamental nursery crops. An innovative approach combining multispectral imaging and deep convolutional neural networks will enable effective plant segmentation and reliable quality assessments. The system's performance will be tested and analyzed in real-world conditions at commercial nurseries, representing different growth stages and levels of canopy occlusion. Beyond its primary objective, the project seeks to harness image-based quality parameters to present nursery managers with valuable insights about the spatial and temporal patterns of plant health across various nursery beds, throughout different seasons and over the years. Stakeholders can capitalize on this knowledge to refine their management practices and manage risks that could impact production. The automated inventory management and quality assessment system, once implemented, will equip nursery managers with comprehensive solutions to drive efficiency, profitability, and sustainability in ornamental nursery production over the near and distant future.

Title: Will you vote? How memorable messages influence first time voters' political attitudes and voting behaviors

Primary Author: Hannah Katharina Raitz

Additional Authors:

Department/Program: Communication

College: College of Liberal Arts

Abstract: Brief messages that have a lasting impact on an individual are called memorable messages. It has been found that memorable messages impact behavior, but research has mainly focused on health behaviors. This study is the first to examine the impact of memorable messages on voting intentions. Subjects of the study are 18-26-year-old American first-time voters in the 2024 presidential election. Guided by the Theory of Planned Behavior, which suggests that intentions form based on attitudes, norms, and efficacy, participants will first be interviewed about the content of the received message and on their beliefs about voting. Secondly, data on attitudes, norms, and efficacy regarding voting as well as voting intentions will be gathered through a quantitative survey. It is expected that positive memorable messages lead to more positive attitudes towards voting, stronger subjective norms, and higher voting efficacy, which in turn lead to higher voting intentions. By the Research Symposium, data analysis and interpretation will be almost completed, so that substantive results can be offered. The study's findings speak about the relevance that childhood messages hold regarding behavioral intentions later in life and can be used to educate families and educators on how to talk to children about voting.

Title: Understanding the impacts of genetic counseling on coping styles of families with positive cystic fibrosis carrier screening

Primary Author: Hannah Montgomery

Additional Authors:

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Cystic Fibrosis (CF) afflicts approximately 30,000 people in the US, with 1 in 30 people being a genetic carrier. Fortunately, there is a high prevalence of carrier screening, particularly around pregnancy and childbearing years, which can better help the individual understand, process and cope with a positive genetic test. However, genetics is inherently a family matter, leading to some couples participating in genetic counseling to navigate diagnoses and concerns. However, the genetic counseling literature has largely overlooked the dyadic coping processes in reviews of the efficacy and outcomes of counseling, leading to a gap in our understanding of the nuanced effects of genetic counseling on relationships and subsequent coping and adjustment. Thus, the present project seeks to answer the following research question: How does participating in genetic counseling impact the coping styles observed in married partners after a positive cystic fibrosis carrier screening? The present project will employ a snowball sample method to recruit couples who have attended genetic counseling after receiving a positive CF screening within the last 2 years. Eligible couples will be contacted and a conjoint semi-structured interview will be scheduled; this will take place on zoom, be recorded, last approximately 1 hour, and consist of 11 questions around the impact of a positive CF screening and genetic counseling on their individual and relationship (dyadic) coping. Interviews will be read line-by-line and categorized according to conceptual meanings or labels. In the final stage, the categories will be arranged into a graphical model that highlights theoretical ideas or processes that emerge. The results from this project will identify the dyadic coping processes so that genetic counselors can better help couples with a positive CF screening and ultimately improve their psychological and relational functioning.

Title: The impact of emotion (dys)regulation on eating disorder outcomes: A longitudinal examination in a residential eating disorder treatment facility

Primary Author: Hannah Sawyer

Additional Authors: Tiffany Brown;Tracy Witte;Olivia Clancy;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Eating disorders (EDs) are a complex set of disorders associated with a high rate of comorbidities and deleterious outcomes (e.g., medical complications, high rates of death by suicide). The complexities of EDs are further compounded by treatment dropout, poor treatment outcomes, and relapse. One way to better understand said complexities is to investigate broad, transdiagnostic risk factors that contribute to the etiology and maintenance of EDs. An established risk factor in the ED literature is emotion regulation, or lack thereof. Limited work has examined longitudinal changes in ED and emotion dysregulation in residential treatment centers. As such, we sought to longitudinally examine the relationship between emotion (dys)regulation and ED outcomes in a sample of 101 female ED patients in a southeastern U.S. residential ED treatment facility. Consistent with our hypothesis, there were statistically significant improvements in both emotion dysregulation and eating pathology from admission to discharge. Further, improvements in one's ability to engage in emotion regulation strategies was a statistically significant predictor of improvement in ED cognitive symptoms. These findings are consistent with previous literature that substantiates the role of emotion dysregulation in eating disorders and provides further evidence for the impact of emotion dysregulation on eating pathology in residential eating disorder patients. Though additional work is needed to improve and validate treatment approaches in residential treatment centers, the current study provides promising evidence that the treatment in these centers is associated with improvement in emotion dysregulation and ED pathology/risk.

Title: The effects of positive distraction through biophilic design on children in a pediatric primary care clinic

Primary Author: Hannah Seales

Additional Authors: Kelly Martin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Positive distractions in interior design are features that evoke positive feelings through engagement in behaviors that distract from stressful emotions. Several studies show that positive distractions in healthcare facilities can reduce feelings of anxiety and improve perceptions of care quality among patients and their families. Many of these studies cover positive distractions through interactive media and play, but few studies show the effects of positive distractions created through biophilic elements, such as natural light, indoor water features, and views of nature. This experimental study will investigate the potential impact of biophilic design elements on anxiety levels and perceptions of care quality among patients in a pediatric primary care facility. Biophilic design interventions will be incorporated in four strategic areas within the clinic: (1) the waiting room, (2) the immunization and vaccination area, (3) the examination room, and (4) the mental health treatment area. In the first condition, a comparison will be made between patients in two conditions: in a room with window shades closed or in a room with window shades open, allowing a view of nature. In the second condition, patients will have access to an outdoor garden. Finally, in the third condition, there will be some public spaces that include water elements. Outcomes will be assessed through a combination of interviews and physiological stress response measures. The study will be a contribution to the growing body of knowledge on the impact of nature and positive distraction as design elements in healthcare spaces. Thus, we are filling a knowledge gap regarding the impact of positive distraction through biophilic design in outpatient settings.

Title: Surface functionalization of HIPS surface: Understanding mineral growth kinetics

Primary Author: Harrish Kumar Senthil kumar

Additional Authors: Abdullah Al Nahian;Lauren Beckingham;Bryan Beckingham;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Mineral dissolution and precipitation reactions occur in a wide range of environmental systems including natural weathering progresses, acid mine drainage, and geologic CO2 sequestration. Such reactions can largely impact flow and transport in porous media by alternating porosity and permeability. Understanding such changes in formation properties is challenging due to a lack of understanding of mineral reactions and reaction rates in porous media systems. Furthermore, geological systems are highly heterogeneous, differentiating in pores and grains and having additionally complex mineral profiles. As such, understanding the impacts of porous media properties on geochemical reactions is challenging due to the highly heterogeneous nature of rock samples. Therefore, one of the ways to replicate these reactive rock samples to investigate the impact of mineral reactions on porosity and permeability in geologic CO2 sequestration systems is 3D printing. Here, a surface functionalization approach is used to promote the surface nucleation and growth of calcite and witherite. The precipitation of mineral phases on 2D surface functionalized high-impact polystyrene films is first considered and characterized using XRD analysis. Weight based precipitation experiments showed increased precipitation with increasing extent of surface functionalization and demonstrated that surface chemistry plays a significant role in precipitation of mineral phases on 2D films. This approach is extended to surface functionalization and precipitation of calcite crystals within 3D printed porous media structures. Overall, this study provides a platform to fabricate 3D reactive rock sample replicates to evaluate different mineral reactions, including precipitation, within porous structures for enhanced understanding of geochemical reactions in reactive systems.

Title: Role of Nerve Growth Factor on Diabetic Cardiomyopathy

Primary Author: Hassan Ali H Jafari

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

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Diabetic cardiomyopathy (DCM) is a form of heart disease that is commonly seen in diabetic patients. DCM is a unique heart failure disease because it can develop even in the absence of other cardiac risk factors such as hypertension and coronary artery disease. Hyperglycemia and elevated levels of free fatty acids increase oxidative stress, reactive oxygen species (ROS) production, apoptosis, and inflammation, thereby resulting in the progression and development of DCM. Nerve growth factor (NGF) is a neurotrophic factor, involved in neuronal cell survival and proliferation. Recent studies have reported that NGF exerts pro-survival and antiapoptotic effects on cardiomyocytes; however, the precise mechanism of its cardioprotective role is yet to be investigated. The aim of the study was to investigate the effect of NGF on myocardial insulin resistance, oxidative stress, cardiac apoptosis, and inflammation. H92c cells, a rat cardiomyoblast cell line, were treated with palmitic acid (PA), high glucose medium (HG), and NGF for 48 hours. Through Western blot analyses, we found that HG treatment induced myocardial insulin resistance. Combination of PA and HG treatment increased oxidative stress and increased apoptotic and inflammatory markers in cardiomyocytes. Notably, NGF administration prevented DCM through the inhibition of myocardial insulin resistance, oxidative stress, cardiac apoptosis and inflammation via activation of PI3K/Akt pathway. These findings provide insight into a possible molecular mechanism of NGF in preventing PA- and HG -induced diabetic cardiomyopathy.

Title: Vaccine outreach program: providing education and personalized vaccine recommendations for community dwelling older adults.

Primary Author: Heather Vance

Additional Authors: Nick McCormick;Salisa Westrick;Lena Mcdowell;Oluchukwu Maureen Ezeala;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: The vaccine outreach program is an interactive community health initiative focused on providing education and making personalized vaccine recommendations for adults aged 65 and older. The Centers for Disease Control and Prevention (CDC) vaccine recommendations are complex. Healthcare providers must consider multiple factors, including age, health conditions, vaccination history, and other risk factors, when making personalized vaccine recommendations for each individual patient. In Alabama, immunization rates for seasonal and routine vaccinations are not optimal. Reasons for these low immunization rates include patients' limited knowledge of what vaccines are required and low vaccine confidence. Therefore, this vaccine outreach program seeks to 1) provide general vaccine education and 2) offer personalized vaccine recommendations, with the goal of increasing vaccine confidence and intention to obtain the needed vaccines from healthcare providers. Starting in Spring 2024, multiple vaccine outreach sessions will be offered in various community settings in the Auburn/Opelika areas such as the Lee-Russell Council of Government and Churches. For each vaccine education session, older adults will participate in multiple activities, including a general education session, a personalized needs assessment using the CDC assessment tool, a vaccine history review using the State Immunization Registry, as well as patients' immunization records, and personalized recommendation counseling. Measures to assess program effectiveness include perceived knowledge gained, perceived empowerment to use knowledge for themselves and others, likelihood of seeking recommended vaccinations, and satisfaction with counseling. Results will be used for program improvement. The vaccine outreach program is important in improving community health, preventing illness, and empowering patients to be part of the decision-making process.

Title: Activating sleep-active neural pathways with focused ultrasound

Primary Author: Henry Limbo

Additional Authors: Julia Peterson;Danielle Forbus;Vander LeKites;Natasha Wendy Grabau;Daniel Kroeger;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Although researchers have not come to a consensus on the function(s) of sleep, there is strong evidence that sleep is necessary for many physiological and cognitive processes including learning and memory. Previously, sleep enhancement in mice required the use of transgenic mice (expressing the protein cre-recombinase in certain neuronal populations) and the use of invasive techniques such as optogenetics or chemogenetics to activate the neurons generating sleep. To facilitate the translational application of this research to humans, we utilized focused ultrasound (fUS) to non-invasively activate neurons in the nucleus accumbens (NAc) which has been shown to be one of the centers involved in sleep modulation. In preliminary experiments with cFos staining, we have shown that the desired structures can be activated will fUS. Our next aim is to determine what specific parameters of fUS will be most effective in stimulating only the desired neuronal populations while leaving neighboring neurons unaffected. We will use both wild-type and transgenic mice in conjunction with calcium imaging to determine the optimal parameters of fUS. We will then use fUS to activate neurons in the NAc to enhance sleep in mice non-invasively. Next, we will assess their performance in the novel object recognition (NOR) test to determine the relationship between sleep enhancement and memory performance. We hypothesize that mice who receive fUS stimulation of the NAc will sleep better and will perform better on the NOR test than unstimulated controls.

Title: Modeling presynaptic vesicle mechanics with a modified ideal gas law

Primary Author: Henry Stephens

Additional Authors:

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: The brain is made up of billions of interconnected cells called neurons. Each neuronal connection involves a synaptic connection where a signal travels from a presynapse to a postsynapse. How the strength of the synapse connections change over time is called plasticity. There are two different kinds of plasticity where synaptic communication either increases or decreases. One kind of increasing plasticity is called long-term potentiation (LTP). Typically, LTP is studied by looking at changes that occur on the postsynapse side. However, it is not completely understood how much presynaptic changes contribute to LTP. This project seeks to create an experimental and model framework for how molecular changes in the presynapse mediate LTP. We used fluorescent microscopy to observe and record the mobility and mechanics of neurotransmitter carrying presynaptic vesicles, which are used in synaptic communication, to understand how presynaptic changes support LTP. We observed vesicle movement during LTP in combination with computational analysis to quantify changes in vesicle dynamics. We then used experimentally observed changes in vesicle mechanics to develop a model to predict how changes in presynaptic function support LTP.

Title: Community pharmacist-led medication services for homebound older adults living with dementia: pharmacy, home health, and aging services perspectives

Primary Author: Heqin Yang

Additional Authors: Natalie Hohmann;Amber Hutchison;Janna Lewis;Morgan Keller;Kyle Smith;Sophia Yantko;Kate Spratlin;Tanner Warhurst;Cade Pritchett;Mason Reed;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: This study explored community pharmacist (CP), home health agency (HHA) provider, and aging service representatives' knowledge, attitudes, and recommended strategies to initiate a CP-led medication management service for homebound older adults living with dementia (HOAD) and establish collaborative practice between community pharmacies, HHA, and aging services. CP, HHA providers, and aging services representatives in the Southern US were recruited to participate in semi-structured telephone interviews from January to June 2023. Participants were recruited via a faxed study invitation using contact information obtained from the Hayes Directory, SeniorCare Directory, and National Provider Identification (NPI) Registry. Interview questions were informed by the Consolidated Framework for Implementation Research (CFIR). Interviews were audio-recorded and transcribed verbatim. Multiple coders conducted rapid content analysis using an Excel template to deductively code transcripts based on CFIR domains. Coding and themes were discussed among the investigators until consensus was reached. As a result, interviews with 18 CP, 9 HHA providers, and 7 aging services representatives were completed, for a total of 34 interviews. Three themes emerged from CP interviews: 1) Facilitators and barriers to initiate pharmacist medication management for HOAD; 2) Suggested strategies to initiate interdisciplinary collaborations; and 3) Individualizing the service by adjusting delivery mode, frequency, content, and intensity. Three themes emerged from HHA and aging services interviews: 1) Service business model; 2) Needed resources; and 3) Service elements. In conclusion, the findings of this study inform the design of CP-led medication management for HOAD and the collaborative practice model between community pharmacies, HHA, and aging services. Future studies may test this collaborative practice model to help overcome identified barriers.

Title: Financial literacy and investment decisions: Survey of Auburn University students

Primary Author: Hipolito Davila

Additional Authors: Jitka Hilliard;

Department/Program: Finance

College: Harbert College of Business

Abstract: This research explores the relationship between financial literacy and investment behavior among university students. The study employs a comprehensive three-part questionnaire to gather essential data. The first section focuses on collecting demographic information. The second part investigates the investment behavior of students and their reliance on student loans. The third and crucial part measures financial literacy, utilizing questions developed by the FINRA Foundation. Using the data collected from the survey, we evaluate the relationship between financial literacy and students' financial and investment behavior. In addition, we document differences in financial literacy among different groups. The findings from this research are expected to contribute significantly to the understanding of financial behaviors among university students. It can help develop targeted financial education programs, improve investment decision-making among students, and foster a more financially literate university community. The implications of this study are far-reaching, potentially influencing policy decisions, educational curriculum design, and individual financial planning for students.

Title: Rhythm Detection and Timing in Adults Who Stutter and Those With ADHD

Primary Author: Hope Hartley

Additional Authors: Gregory Spray;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: People who stutter have previously been shown to exhibit rhythm and timing deficits compared to controls. Research shows that adults who stutter exhibit worse rhythm discrimination for complex rhythms compared to controls, but not for simple rhythms. These findings support the Atypical Rhythm Risk Hypothesis, which posits that differences in neural networks supporting rhythm perception may be one fundamental component of stuttering. ADHD is characterized by deficits in perceptual and motor timing, which is similar to stuttering. Thus, examining rhythm perception may reveal similarities between ADHD and stuttering. Individuals 18-50 years of age were recruited for this study using fliers and word of mouth. To participate, participants had to speak/understand English and have typical speech, language, and hearing development (other than stuttering or ADHD). The purpose of this study was to determine if adults with ADHD exhibit differences in rhythm perception compared to controls. We hypothesize that no differences in simple rhythm detection will exist between adults with ADHD and the control group. We also theorize that adults with ADHD will have more difficulty detecting complex rhythms than controls and that Individuals with higher ADHD Index scores will have more difficulty with rhythm discrimination.

Title: Dynamics of nitrogen use and loss in croplands responses to soybean cultivation in an intensified agricultural basin in South America

Primary Author: Hua Yan

Additional Authors: Latif Kalin;

Department/Program: AU National Resource Management and Development Institute

College: College of Forestry, Wildlife and Environment

Abstract: Sustainable Nitrogen (N) management is critical for agricultural production, by balancing the tradeoffs between maintaining soil N content and reducing N loss. Optimizing N input in soybean cultivation areas is imperative to maximize yields while minimizing environmental impacts, as Biological N Fixation (BNF) by soybeans make these lands particularly vulnerable to N surplus and excessive N export to downstream waters. Yet, the spatiotemporal soil N dynamics in large agricultural basins with intensive soybean production remain poorly understood. This study proposed a comprehensive framework to simulate the dynamics of N use and loss in soybean areas across the transnational agricultural basin, La Plata, in South America from 2001 to 2016. We identified and compared the N dynamics between two soybean zones, the established and recently converted soybean areas. Results revealed that the increase in fertilizer N input is 38 % higher than non-fertilizer N input , like BNF and atmospheric deposition. On average, the N surplus increased 19% over 16 years, and mean annual N surplus exceeds the recommended threshold by 15%. Around 29% of the soybean areas experience high risks of N loss through leaching and soil erosion, especially in the Brazilian La Plata. Compared to recently converted soybean zones, areas with established soybean cultivation exhibited a 5% higher risk of N loss through leaching and a 12% higher risk through soil erosion. Our findings highlight the general excessive fertilizer N inputs in soybean areas in this basin, emphasizing the importance of cross-national collaboration in N management in agricultural production.

Title: Cost-effectiveness analysis of cemiplimab plus chemotherapy in advanced non-small cell lung cancer (NSCLC) with at least 50% programmed cell death receptor ligand-1 (PD-L1) positivity

Primary Author: Ibrahim Alfayoumi

Additional Authors:

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: The EMPOWER-Lung 3 trial showed that cemiplimab plus chemotherapy significantly prolongs the duration of progression-free survival and overall survival in advanced non-small cell lung cancer (NSCLC) patients with at least 50% programmed cell death receptor ligand-1 (PD-L1) positivity, yet the financial burden may limit its use. The aim of this study was to evaluate the cost-effectiveness of cemiplimab plus chemotherapy versus cemiplimab alone based on a US payer perspective. A partitioned survival model was developed to assess three health states: progression-free, progression, and death. Clinical outcomes from the EMPOWER Lung 1 and 3 trial studies were obtained. In the absence of head-to-head studies, indirect treatment comparisons were conducted to capture the comparative effectiveness between cemiplimab plus chemotherapy and cemiplimab. Utility values for NSCLC states and adverse events disutility values were based on published data Wholesale acquisition costs for treatments were sourced from Redbook, adverse event costs (grade 3/4; all grades for immunotherapy-related AEs) utilized published data, and monitoring costs were based on Physician Fee Schedules. All costs were based on 2023 US$. A 20-year time horizon was adopted, and a 3% discount rate was applied to costs and utilities after year 1. Exponential regression was utilized to extrapolate the cemiplimab plus chemotherapy overall survival (OS) Kaplan-Meier curve, while Weibull regression was applied for extrapolation of the cemiplimab alone OS curve. For a 20-year time horizon, Probabilistic Sensitivity Analysis showed an incremental cost of cemiplimab plus chemotherapy over cemiplimab alone of $29,881, an incremental life year (LY) of 0.07, and an incremental quality-adjusted life year (QALY) of 0.05, yielding an incremental cost-effectiveness ratio (ICER) of $455,091 per LY and an ICUR of an incremental cost of $639,227 per QALY. Compared to cemiplimab alone, cemiplimab plus chemotherapy was not cost effective for NSCLC patients with at least 50% (PD-L) at a threshold of $150,000 per QALY in the US.

Title: Future Generation of Oncolytic Adenoviruses

Primary Author: Isabella Shimko-Lofano

Additional Authors: Payal Agarwal;

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: Oncolytic adenovirus therapy is a potential immunotherapy modality for cancer treatment. However, we need enhanced adenoviruses to exclusively target cancer cells, conditional replication, reduce toxicity, and be armed with immunostimulatory agents to increase the immune systems in the tumour microenvironment (TME). Our research group has modified canine adenovirus type two (CAV2) and has created two modified oncolytic adenoviruses (CAV2-AU-M2 and CAV2-AU-M3). CAV2-AU-M2, has immunogenic checkpoint inhibitors, anti-PD-1 sdAb (single domain antibody or nanobody), and red fluorescent protein (DsRed) inserted. CAV2-AU-M3, has caninized anti-PD1 HcAb (heavy chain antibody) with a secretory signal inserted between fiber and E4 genes. We are working to insert the secretory caninized anti-PD1 HcAb by replacing E3. CRISPR/Cas9 and yeast homologous recombination were used to insert and replace the transgenes and polymerase chain reaction was used to verify the correct location and size of the transgenes. CRISPR/Cas9 and homologous yeast combination were effective tools to modify CAV2 genetically, and the next step in packaging a newly modified virus is the transfection of the linearized modified virus genome in adenovirus packaging cell line DKcre. The modified viral genome will be sequenced to verify the correct modification in the virus genome. The virus will be assessed for its infective and cytolytic properties upon the virus packaging.

Title: Doxorubicin-induced alterations in hippocampal glutamatergic neurotransmission

Primary Author: Iva Durdanovic

Additional Authors: Miranda Reed;Emma Redmon;Miles Wiley;Adrian Courville;Kawsar Chowdhury;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Doxorubicin is one of the leading drugs that cause long-term cognitive deficits, often called chemobrain. As observed in over a third of breast cancer patients prescribed doxorubicin, cognitive symptoms post-treatment persist due to the drug's ability to induce neurotoxicity despite negligible amounts breaching the blood-brain barrier. Extensive clinical efforts to improve chemobrain symptoms have made minimal progress, possibly due to the underlying mechanism of doxorubicin-induced chemobrain being unknown. In this study, we test the hypothesis that doxorubicin-induced chemobrain dysregulates glutamate levels, resulting in excitotoxicity and impaired synaptic plasticity in an animal model of chemobrain. We aim to investigate the effects of doxorubicin on the expression and quantification of synaptic proteins (i.e., NMDA receptors) and downstream signaling pivotal to learning and memory formation through a series of techniques including electrophysiology and immunoblotting. Our findings are anticipated to establish mechanistic interplay through which doxorubicin disrupts synaptic plasticity, potentially elucidating the multifaceted dysregulation of cognitive processes surrounding glutamate signaling and neurotransmission. By bridging the gap between doxorubicin treatment and glutamate excitotoxicity, this research not only advances the fundamental knowledge of chemotherapy-induced cognitive deficits but also clinically relevant glutamate-modulating targets directed to mitigate the cognitive symptoms, thus enhancing patients' overall quality of life during and after chemotherapy. The comprehensive nature of this work and future outcomes will significantly contribute to both the oncology and neuroscience fields.

Title: Random mutagenesis of eight Vibrio species and validation by sequencing as part of developing a broad-spectrum genetic tool kit for recombineering

Primary Author: Jackson Wells

Additional Authors: Katherine Buckley;Jake Tatum;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The process of induced random mutagenesis, or “random screening”, of microbial organisms is a useful and cost-effective tool in industrial microbiology for generating desired changes in microbial populations through external selective pressure. Genetic mutations that arise throughthis process can generate a variety of phenotypes that can be used to assess gene function. Asgram-negative, marine bacteria, Vibrio sp. are particularly challenging to genetically manipulatein laboratory settings. The goal of this work is to generate a suite of Vibrio sp. that are resistantto the aminoglycoside antibiotic streptomycin as part of a larger project to developrecombineering tools in these species. The antibacterial activity of streptomycin is due to itsability to inhibit protein synthesis by binding to the 16srRNA sequence and the ribosomal proteinS12 (rpsL). Streptomycin resistance can be induced by single-point mutations in the rpsL gene.To mutate rpsL, bacteria are exposed sublethal concentrations of streptomycin and grown overmultiple generations. Mutant strains will be used in whole-genome sequencing to identifyspecific mutations associated with the resistant phenotype. These streptomycin-resistant mutants(rpsLR) will be used in downstream applications of specific recombineering strategies togenetically modify chromosomal DNA in Vibrio species.

Title: Application of ultrafast gas chromatography electronic nose to characterize warmed-over flavor in chicken muscle and skin

Primary Author: Jacob Dees

Additional Authors: Michelle Hayden;Linda Barahona Dominguez;Sungeun Cho;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Electronic sensing technologies (e.g., electronic nose) have significantly improved over the last decades. It recognizes aroma patterns, providing fast aroma analysis. In this study, we used the Heracles Neo II Alpha MOS electronic nose (e-nose) (Alpha MOS, Toulouse, France) to characterize warmed-over flavors (WOF) developed in reheated oven-grilled chicken muscle and skin. On Day 0, chicken breast, thigh, and skin were grilled in a commercial oven at 190 degrees C for approximately 30 min until the internal temperature reached 80 degrees C. Over the 3-day storage period, the chicken samples were stored in Ziploc bags at 4 degrees C. The stored chicken samples were reheated until the internal temperature reached 80ol degrees C using either a microwave (SHARP 1200W Commercial Microwave) at 180 degrees C or an air fryer (Kaloric 5-Quart Digital Air Fryer). The aroma analysis using the e-nose was carried out in triplicate on each chicken sample on Days 0, 1, 2, and 3. Overall, Principal Component Analysis (PCA) of the e-nose data showed the differences in the volatiles of all chicken samples reheated using microwave or air fryer from the 3-day storage period with a total variance of 97.0%. The different reheating methods over the 3-day storage period affected the WOF of breast, thigh, and skin samples with a discrimination index of 93%, indicating good discrimination. The volatile analysis found more alkanes (e.g., 3-ethylpentane, 3-ethylhexane, and 4-methyl-octaine) in skin samples when compared to breast and thigh samples. These alkanes were formed from the lipid oxidation from the skin, which prompted the development of lipid oxidation over storage time. This study confirmed that the e-nose was able to characterize and differentiate WOF between chicken muscle and skin in a quick time frame.

Title: Does thermal tolerance vary across different populations of pinfish?

Primary Author: Jacob Samenuk

Additional Authors: Katie Eaton;Moises Antonio Bernal de Leon;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Pinfish (*Lagodon rhomboides*) are vital to coastal ecosystems in the Gulf of Mexico and Atlantic Ocean as they are extremely abundant and serve as a prey source for many commercially relevant fishes, seabirds, and marine mammals. Despite their ecological importance, not much is known about their thermal tolerance. It is particularly important to understand the thermal performance of marine fishes, such as pinfish, because global ocean temperatures are increasing and marine heatwaves are intensifying due to human-mediated climate change. Species that inhabit shallow-water ecosystems, such as juvenile pinfish, may be particularly vulnerable to these changes. Therefore, it is crucial to study thermal physiology of different populations of this species, which may help us to understand their ability to adapt to a warming ocean. Pinfish were collected from Wilmington, NC, Marathon, FL, Perdido Bay, AL, and Port Aransas, TX. We measured the upper thermal tolerance (CTmax) of 12 pinfish per locality, by exposing them to a 0.3C/min temperature ramp until loss of equilibrium was recorded, representing the point at which typical swimming function is impaired. Additionally, we did genetic analysis on 12 fish per population by examining the sequences of two mitochondrial genes (CytB and CO1), with the goal of understanding the genetic divergence of the different populations. We found that there was no significant difference in CTmax among populations. Preliminary mitochondrial genetic results show no evidence of genetic difference across populations, with 2 major haplotype groups that do not separate by locality. This indicates thermal tolerance is conserved across populations in this species. Additional genetic results for more mitochondrial genes to strengthen our phylogenetic resolution are forthcoming. Based on our findings, there appears to be no genetic difference among populations, nor differences in CTmax across pinfish populations. This may affect the pinfish’s ability to adapt to a changing climate.

Title: The biomechanical analysis and fatigue testing of 3D-printed ankle-foot-orthoses

Primary Author: Jacquelyn Brokamp

Additional Authors: Amanda Sterling;Michael Zabala;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Ankle-foot orthoses (AFOs) are the most common orthotic used to treat patients with musculoskeletal and neurological disorders who experience impaired gait. AFOs normalize gait patterns by providing an external support to the lower limb, which restricts spastic muscles. The conventional manufacturing technique used to produce custom-fit thermoformed polypropylene AFOs is laborious and time-consuming. Additive manufacturing has recently been explored as a possible solution to decrease manufacturing time while also improving user comfort and cost efficiency. AFOs are intended to be worn daily, but it is not yet understood how much loading a 3D-printed AFO device can endure. The purpose of this study was to determine the loading profile exerted on an AFO during activities of daily living. Accordingly, a gait analysis was performed to capture the loading profile of a user while wearing an AFO. The participant was scanned using XO Armor 3D-scanning technology to create a 3D-printed, custom-fit AFO. A Vicon motion capture system was used to capture the kinematic and kinetic data of the participant while they were walking and jogging. The subject was asked to perform each action while wearing an AFO and while not wearing an AFO. The ground reaction force, ankle moment, and ankle joint angle were used to evaluate the effects of the AFO during gait. The data collected from this study will be used in the future to conduct benchtop cyclic testing on the AFO to simulate the forces the device would experience while being worn. This data will determine the strength and fatigue resistance of an additively manufactured AFO and will provide insights into suggested durations of use by the patient.

Title: Mechanisms of sensitivity of MLL-AF4 cells to proteasome inhibitor bortezomib

Primary Author: Jacquelyn Fitzgerald

Additional Authors: Alexei Kisselev;Tyler Jenkins;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: The t(4;11)(q21;q23) chromosomal translocation leads to a rare and aggressive form of acutelymphoblastic leukemia (ALL) in infants, resulting in a low survival rate. The fusion proteinMLL-AF4, produced due to this translocation, renders cells more sensitive to the proteasome inhibitor (PI) bortezomib (Btz). However, the mechanisms underlying this sensitivity still need to be better understood. This study investigates the mechanisms by which MLL-AF4 cells are sensitized to PI. A previous paper titled "Proteasome inhibition targets the KMT2A transcriptional complex in acute lymphoblastic leukemia" suggested that histone ubiquitination,specifically H2B ubiquitination, is involved in PI-induced cell death. However, our preliminary data contradict this finding, indicating that another mechanism may be at play. We propose that MLL-AF4 expression sensitizes cells to PIs by upregulating protein synthesis and causing proteotoxic stress. The objectives of this project are twofold: (1) to compare the prevalence and significance of two proposed mechanisms of sensitivity, histone ubiquitination (specificallyH2B) and increased protein synthesis leading to proteotoxic stress, and (2) to evaluate the effect of proteasome inhibitors on tumor growth in mice. To achieve these objectives, we will develop an assay to measure histone ubiquitination and analyze existing samples of MLL-AF4 cells to assess H2B ubiquitination levels. Additionally, we will conduct animal studies using mice treated with Btz in combination with other therapies to measure tumor growth and assess potential toxicity by monitoring bone length. By elucidating the mechanisms underlying the sensitivity of MLL-AF4 cells to PIs, this research aims to identify therapeutic targets and improve treatment outcomes for patients with this aggressive form of ALL.

Title: Dietary fiber inspired cosmetic gels for hypo and hyperpigmentation

Primary Author: Jada Neal

Additional Authors: Symone Alexander;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Skin discoloration is a common disorder of pigment-forming skin cells. The type and distribution of melanins has one of the greatest influences on skin pigmentation, which is differs for each individual. This research project investigates the use of pectin hydrogels in cosmetic and skin care applications. Pectin is a complex polysaccharide starch found in the cell walls of most fruits and vegetables, making it a readily available resource. It is commonly used as an emulsifier and thickener, but also offers potential benefits regarding treatment of discoloration, anti-ageing, and smoothing uneven skin tone. Hyaluronic acid is a naturally occurring substance found in the body's joint and eye fluid. It serves the role of retaining moisture and aiding in tissue lubrication and skin flexibility. The focus is on the extraction of pectin from dietary fiber, which will be crosslinked using hyaluronic acid, allowing for the characterization and eventual preparation of hydrogels for further rheological and in vivo response studies using FTIR and NMR testing. With this proposed study, my research aims to confirm the complex use of pectin with hyaluronic acid in skin care and treatment products.

Title: Validation of an Earth Observation-Based Forest Aboveground Biomass Map: A Case Study of Alabama

Primary Author: Janaki Sandamali Kuda Udage

Additional Authors: Lana Narine;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Forests store approximately 80% of Earth's biomass, playing a crucial role in the global carbon cycle, biodiversity conservation, and climate regulation. Alabama's forests are integral to both the state's biodiversity and economy. Accurate estimation of aboveground biomass (AGB) at the state level is essential for effective forest management and planning. The Global Ecosystem Dynamics Investigation (GEDI) is a high-resolution light detection and ranging instrument designed specifically to retrieve vegetation structures from space. GEDI provides a range of data products, and GEDI Level 4A offers aboveground biomass density (AGBD) at the footprint level. In this study, we extrapolated AGB estimates from the GEDI mission data, using satellite imagery and earth observation (EO) data, and compared the output with currently available and well-established AGB products. For field-based estimates, we used the US Forest Service Forest Inventory and Analysis (FIA) program data from a network of permanent ground plots across Alabama. Then we integrated globally available AGB products, including the European Space Agency Climate Change Initiative (CCI) AGB product and the GEDI Level 4B (L4B) Gridded AGBD product. We aggregated FIA plot-level data to the county level and compared it with the estimated AGB. Subsequently, the AGB estimates were resampled to the respective resolutions of CCI (100m) and GEDI L4B (1km) for comparison. Results of the study show good correlations between FIA data, CCI, and GEDI L4B, with the EO-based AGB product. This validation exercise offers guidelines for prospective remote sensing studies, highlighting inconsistencies among biomass products across diverse platforms. Consequently, it underscores the imperative for further research to enhance understanding and develop methodologies for generating harmonized AGB products.

Title: Hatha yoga improves anxiety and stress for middle-aged women.

Primary Author: Janki Patel

Additional Authors: Kristina Neely;Danielle Wadsworth;Jack Gaddy;Kathryn Riis;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Hatha yoga may improve mental health (Klatte et al., 2016). Eighteen women, ages 25-55, completed 8 weeks of group hatha yoga, twice a week for one hour (16 sessions total). Prior to the first session and after the last session, participants completed questionnaires related to mental health, mindfulness, and sensory perception. Dispositional mindfulness was measured with the Mindful Attention Awareness Scale (MAAS), which has one outcome score (range 1-6). Tendency to regulate emotion was assessed with the Emotion Regulation Questionnaire (ERQ), which has two subscales, cognitive reappraisal (range 6-42), and expressive suppression (range 4-28). Depression Anxiety Stress Scale-21 (DASS-21) has subscales for depression, anxiety, and stress (scores range 0-34). Fourteen participants completed the intervention and post-test. Change over time was evaluated by six repeated measures t-tests. Dispositional mindfulness at post-test (3.72   1.03) did not differ from baseline (3.74   0.84), $p > .05$. ERQ-cognitive reappraisal at post-test (4.79   1.19) did not differ from baseline (5.14   1.10), and ERQ-expressive suppression at post-test (3.21   1.55) did not differ from baseline (3.16   1.27), $ps > .05$. All subscales of the DASS-21 demonstrated improvement; however, the depression subscale did not reach traditional levels of significance. DASS-21-depression at post-test (17.71   4.29) was not different than baseline (18.86   3.82), $p > .05$. DASS-21-anxiety at post-test (17.57   3.61) was less than at baseline (21.14   5.48), $p = .025$. DASS-21-stress at post-test (23.00   6.55) was less than at baseline (27.00   7.09), $p = .017$. The results suggest that participation in hatha yoga may have a positive impact on mental health for women ages 25-55. This is important because hatha yoga is accessible and enjoyable. Future work is required to determine how mental health outcomes may differentially be affected by the frequency, duration, and style of yoga.

Title: Doxorubicin-induced cognitive impairment and synaptic plasticity

Primary Author: Jannah Adams

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Doxorubicin is one of the most prominent drugs that causes chemotherapy-induced cognitive impairment, known as "Chemobrain." This is prevalent in over 75% of breast cancer patients who are oftentimes prescribed Doxorubicin. The interaction between the production of glutamate and disruption in Long-Term Potentiation (LTP) directly affects the brain's cognitive ability. Based on preliminary research, Doxorubicin has been established to cause an imbalance in glutamate neurotransmission, partially due to the disruption in the function of glutamate AMPA-mediated signaling. Furthermore, it impairs hippocampal synaptic plasticity which causes a decline in learning and memory ability. Through an assessment of behavioral tests, electrophysiological measurements, and immunoblotting, our research demonstrated Doxorubicin's ability to indirectly influence the brain's capacity to develop memories and its potential to retain long-term information. This means that the drug significantly causes cognitive impairment even though it does not have direct access to the brain by crossing the Blood-Brain Barrier (BBB). While previous efforts have elucidated the effects of Doxorubicin on the AMPA receptor's expression and function, further investigation is needed to clarify the role of NMDA glutamate receptors in chemobrain pathology. Based on this premise, we hypothesize that doxorubicin-induced chemobrain dysregulates glutamate levels, resulting in excitotoxicity-driven synaptic plasticity and long-term memory deficits. In this study, we aim to investigate how Doxorubicin influences the expression of NMDA receptors. Furthermore, we strive to further dissect the mechanistic pathway of Doxorubicin and cognitive decline through the interplay of astrocytes. We anticipate illustrating that Doxorubicin interrupts the brain's neuronal ability to strengthen or weaken over time. As a result of this extensive research, we contribute to the overall advancement of post-cancer treatment.

Title: Investigating the role of CXCL7 in colon cancer progression using 3D engineered tissue models

Primary Author: Jannatul Ferdous Nipa

Additional Authors: Michael Greene;Elizabeth Lipke;Kwaghtaver Samuel Desongu;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Colorectal cancer holds a prominent position among the top three prevalent cancers globally, with a particularly high occurrence in the United States. The advanced three-dimensional (3D) tumor models enhance our comprehension of tumorigenesis, therapeutic development, and imaging and they also facilitate the exploration of innovative treatment approaches. Our research is centered around a tissue-engineered model for colorectal cancer designed to replicate in vivo conditions. In utilizing this 3D model, we examined the influence of the chemokine ligand CXCL7 on colorectal cancer cell proliferation and growth, specifically employing the human colon cancer HT29 cell line. Chemokines, particularly Chemokine(C-X-C) ligand 7 (CXCL7), play a pivotal role in the development of the tumor microenvironment and have been shown to propel cancer progression across various types of cancer. Our preliminary findings suggest that CXCL7 chemokine promotes colorectal cancer (CRC) cell proliferation, consistent with clinical data linking increased CXCL7 levels to adverse outcomes in CRC patients. In this study, we used poly ethylene glycol-fibrinogen hydrogels to engineer a 3D tissue model, demonstrating higher viability over a culture period of 35 days. The experimental outcomes reveal distinct differences between transfected cells expressing CXCL7 and those transfected with the vector, employed as a control. Notably, cells expressing CXCL7 exhibited a marked increase in both growth and proliferation compared to their vector-transfected counterparts. The viability of CXCL7 transfected tissues surpassed that of the vector-transfected tissues from day 1 through day 15 of culture. This research emphasizes the potential of biomimetic 3D models in offering a promising platform for diminishing dependence on conventional models. Additionally, understanding CXCL7's influence on CRC growth within the 3D model opens avenues for further exploration of its potential as a therapeutic target.

Title: Back Needle Rush (Juncus Roemerianus) Survival After Thin Layer Placement

Primary Author: Jannell Clampitt

Additional Authors:

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Coastal wetlands provide vital services like erosion control, storm protection, water quality improvement, and fisheries habitat that coastal communities rely on. However, degradation from sea level rise, storms, and erosion threatens these services and properties, especially in the Gulf of Mexico where substantial land loss results from accelerated sea level rise and erosion. This research aims to find the optimal thin layer placement (TLP) depth to maintain Black Needle Rush (Juncus Roemerianus) plants under Gulf tidal conditions. Using a raised pool with brackish water, 84 buckets filled with dredged material were planted with black needle rush in a two-phase experiment. Phase I established plants for 4 months with 3-13 inches tidal heights. Phase II subjected plants to 11-21 inches tidal heights mimicking the Gulf and TLP depths of 6, 8, 10, 12, and 14 inches, along with an uncontrolled bucket. Plant health indicators like soil compaction, stem size/count, and biomass were monitored over 9 months. Final June data will complete the study. Coastal restoration is costly, so these results will provide guidance on optimal TLP depth and steps to sustain vegetation when existing living shoreline projects require maintenance. In summary, the study makes an important contribution by evaluating TLP impacts on black needle rush growth under realistic Gulf tidal conditions. The findings will inform best practices for maintaining vegetation in coastal restoration projects working to rebuild land lost from elevated sea levels and erosion.

Title: Engineering the chicken microbiome for the prevention of histomoniasis

Primary Author: Jazmine Carroll

Additional Authors: John Beckmann;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Histomoniasis is a parasitic disease seen in poultry that is known to cause severe lesions in the liver. The disease, once contracted by a single bird, can spread rapidly across the population, causing 80-100% flock mortality in turkeys and 10-20 percent flock mortality in chickens. Treatments for histomoniasis include chemical compounds such as nitroimidazoles. However, there are no treatments or preventative drugs that are currently approved by the FDA for use in food-producing birds, leading to large economic losses. The causal parasite of this disease, Histomonas meleagridis, is a protozoan that is transmitted primarily in the eggs of the cecal worm Heterakis gallinarum. The goal of this research is to identify culturable organisms within the cecum that can be genetically engineered to eradicate H. meleagridis from within the cecum, developing an effective probiotic preventative of histomoniasis. Dissection of 5 chickens was performed to collect samples of the ceca microbiome. A total of 8 strains of bacteria were successfully cultured. These strains were identified using the PCR amplification and sequencing of the 16S and 16S-23S genetic regions, as well as Gram-staining procedures. The strains included Bacillus amyloliquefaciens, Escherichia coli, Enterococcus faecium, and Proteus mirabilis. Bacterial transformation of a fluorescent protein into each strain was then attempted using various methods. While no strain has shown initial success in expressing the fluorescent protein, additional trials will be performed to eliminate E. coli contamination and increase success rate. If transformation is successful, the fluorescent markers will be used to quantify where the bacteria will localize in the chicken's digestive system when administered orally.

Title: TGF-Beta and non-canonical Wnt signaling interactions coordinate anterior-posterior and dorsal-ventral axis formation in sea urchin embryos

Primary Author: Jennifer Fenner

Additional Authors: Ryan Range;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: In deuterostomes, the specification and patterning of the anterior-posterior (AP) and dorsal-ventral (DV) axes spatiotemporally overlap. However, we lack a clear understanding of the explicit molecular mechanisms that control these axes in any developmental model organism. 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 along the AP axis. During this progressive AP patterning process, ventrally localized Nodal signaling initiates DV axis specification, establishing opposing Nodal and BMP2/4 signaling gradients activating DV GRNs in all three germ layers. Previously, we have shown that non-canonical Wnt16-Fzd1/2/7 signaling plays a critical role in the sea urchin AP Wnt signaling network. Here, we use functional knockdown experiments to show that Fzd1/2/7 signaling and a different Wnt ligand, Wnt6, are necessary for early Nodal signaling activity, as well as the transcription of bmp2/4 and the dorsal ectodermal GRN. Unexpectedly, our data indicate that nodal transcription is normal in Wnt6 and Fzd1/2/7 knockdown embryos, but phosphorylation of its downstream target Smad2/3 is perturbed. Furthermore, we show that dorsal BMP2/4 signaling is necessary for the activation of a secreted Wnt ligand antagonist, Wnt inhibitory factor1 (Wif-1), in dorsal-anterior blastomeres. Wif-1 functional knockdown assays indicate that Wif-1 is essential for the positioning of the anterior neuroectodermal GRN around the anterior pole during AP patterning. Together, our results illustrate that in sea urchin embryos there are direct interactions among components of the early AP Wnt signaling network and the DV Nodal-BMP2/4 signaling pathways.

Title: Discrimination of foodborne pathogens associated with outbreaks using Tandem Liquid Chromatography Ion Mobility Mass Spectrometry (LC-IM-MS/MS)

Primary Author: Jessica dos Santos Pizzo

Additional Authors: Ahmed Hamid;Orobola Olajide;Kimberly Kartowikromo;Iffat Jerin;Sheba Paul Maaji;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Foodborne illnesses are caused by the contamination of food by pathogenic bacteria, viruses, and parasites. Annually in the United States (U.S.), an estimated 3,000 people die of foodborne disease caused by known pathogens. Between 1998 and 2021, 54.6% of reported foodborne illness outbreaks in the U.S. were related to contaminated vegetables with *Salmonella enterica*, *Escherichia coli*, and *Listeria monocytogenes*. This presentation describes our studies in the development and optimization of novel methods using the liquid chromatography ion mobility tandem mass spectrometry technology combined with statistical bioinformatics to discriminate three *E. coli* of different serotypes, two *L. monocytogenes* of different serotypes, and five *S. enterica*. Bacteria cultured in Luria broth was centrifuged and the resulting pellet was utilized for lipid, intact protein, and peptide analysis. Lipids were analyzed using Data Independent Acquisition (DIA). Different classes, such as phosphatidylethanolamines (PE), phosphatidylglycerols (PG), and cardiolipins (CL) were detected. Their identities were confirmed by their isotopic abundances, exact mass measurements, and fragmentation patterns. For the analysis of peptides, trypsin digestion conditions were optimized to identify a higher number of peptides and proteins. The optimal conditions, resulting in the highest number of peptides were identified as a trypsin-to-sample ratio of 1:30 and an incubation time of 12h. However, for practical considerations, the conditions of a 1:20 trypsin-to-sample ratio and 1h incubation time were selected, as they yielded a comparable number of peptides with a shorter digestion time. The peptides were first analyzed by LC-MS/MS in Data Dependent Acquisition (DDA) mode to build a library on pure bacterial cultures, followed by DIA analysis to identify the unique peptides that can be used as biomarkers in real samples. For intact proteins, an LC-IM-MS/MS method is being developed.

Title: Supporting student mental health in secondary music ensembles

Primary Author: Jessica Walls

Additional Authors:

Department/Program: Curriculum and Instruction

College: College of Education

Abstract: Mental illness affects a large and growing percentage of the adolescent population, and integrating coping strategies that blend seamlessly into standard music education practices and utilize breathing, self-reflection, and the inherent emotional nature of music could potentially enhance student well-being and emotionally impactful performance practices. This presentation synthesizes two studies - one quantitative and one qualitative. The purpose of the quantitative study was to determine the effectiveness of current teaching practices in middle school and high school music ensembles to support students with mental health disorders. Participants (*N*=168) ranged in age from 18-64 and were symptomatic of depression, anxiety, or bipolar disorder while enrolled in a music ensemble classroom for at least one year during their secondary education. Participants completed a survey that included questions regarding their experiences dealing with mental health in an ensemble classroom, coping with feelings of suicide, and the type of support they received from their ensemble director. In the qualitative case study, participants (*N*=4) were secondary choral ensemble directors with mental health struggles who participated in middle school or high school ensembles and shared their lived experiences to explore the most meaningful types of mental health support they received in the past and now offer their own students. In both studies, the most prevalent mentions of meaningful support from ensemble directors included creating a safe and welcoming classroom atmosphere with professional boundaries, avoiding excess pressure on students to compete, and treating students with compassion while honoring their individual intersectional identities. Both studies identified a need for further study to develop pre-service training on mental health and recognizing concerning student behavior in order to offer appropriate support.

Title: Developmental and neurobehavior alterations following early-life exposure to 1-Trichloromethyl-1,2,3,4-tetrahydro-beta-carboline (TaClo) in the zebrafish model

Primary Author: Ji-Hang Yin

Additional Authors: Katharine Horzmann;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: 1-Trichloromethyl-1,2,3,4-tetrahydro-beta-carboline (TaClo) is an endogenous neurotoxicant that can form in the brain after exposure to toxicants such as trichloroethylene (TCE), tetrachloroethylene, or chloral hydrate. TCE is associated with developmental toxicity and neurotoxicity and TaClo is associated with dopaminergic neurodegeneration in adults. The role of TaClo in developmental neurotoxicity is not known. This study tests the hypothesis that early-life exposure to TaClo induces developmental neurotoxicity in zebrafish. A lethal concentration 50 (LC50) for TaClo was calculated at 120 hours post fertilization (hpf) by exposing zebrafish embryos to a range of TaClo concentrations in dimethyl sulfoxide (DMSO) from 1 hpf until 120 hpf. For other endpoints, embryos were statically exposed to 0, 5, 50, 500 ppb TaClo in DMSO for 24 hpf and 120 hpf. Embryo survival and hatching were monitored every 24 hours for 120 hours. A photomotor response test (PMR) was performed at 24 hpf. Larval morphology, cardiac function, and visual motor response (VMR) were evaluated and lethal concentration (LC50) was calculated at 120 hpf. The 120 hpf LC50 of TaClo in the zebrafish model was 7.89 ppm. Zebrafish embryos exposed to 5, 50, or 500 ppb TaClo showed no differences in survival and hatching percentage and heart rate compared to DMSO controls. Larval with early-life exposure to 50 ppb TaClo had a significant decrease in pericardial area. Pronounced PMR alterations were observed in TaClo-treated group with 5 ppb having higher burst activity, burst count, and total burst duration. Additionally, TaClo-treated group at 500 ppb showed significantly shorter mean burst duration. No significant VMR changes were observed. Our results support the hypothesis that early-life exposure to TaClo is associated with developmental toxicity and early-life neurotoxicity in larvae.

Title: Applying Montessori-Based Design Concepts in Higher Educational Settings

Primary Author: Joelene Burrows

Additional Authors: Anna Ruth Gatlin;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Created in 1907 by Maria Montessori, Montessori education is the development of natural skills and potential, as compared to formal educational practices. Montessori education, which is currently confined to K-12, builds upon the establishment and maturing of practical life, and focuses on five curricular categories: sensorial, mathematical, linguistic, and multicultural skills. The built environment (the classroom) must reflect and support these concepts in a way that traditional classrooms do not. Montessori educational practice is most widely applied in pedagogical settings for humans between 2 and 8 years of age, as they are in an age of intense development and growth. It can be posited that college-aged students are also in a period of intense development and growth. The purpose of this poster is to apply concepts of Montessori method-based design elements such as spatiality, material selection, acoustics, and lighting design to a higher educational setting, thereby embracing the pedagogical philosophy's core principle: the emphasis on the 'prepared environment.' The literature shows that application of such principles fosters an environment that facilitates autonomy, critical thinking, exploration, collaboration, motivation, and creativity without overwhelming or causing feelings of anxiety on the still moldable mind. This poster will propose one way that design elements of Montessori can be applied to a typical existing university classroom setting through the framework of the Attention Restoration Theory.

Title: Characterization of the Transient Perinatal Rise in Luteinizing Hormone in Cats and Dogs

Primary Author: Johanna Ehrhardt

Additional Authors: Douglas Martin;Malia Walton;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: Powertrain independent platooning analysis metrics

Primary Author: John Bentley

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Platooning is a coordinated driving strategy in which heavy duty trucks are placed into the wake of leading vehicles. Platooning has two primary benefits. First, the vehicles following are shielded from aerodynamic drag resulting in a “pulling” effect. Secondly, by placing vehicles behind the leading truck, the leading vehicles experience a “pushing” effect. The reduction in aerodynamic drag leads to reduced energy consumption and, consequently, reduced greenhouse gas emissions. To maximize these effects, the inter-vehicle distance needs to be minimized. In current platooning strategy iterations, Coordinated Adaptive Cruise Control (CACC) is used to safely maintain close following distances. These platooning benefits have been seen to be sensitive to disturbances during travel. To better account for these disturbances, nonlinear model predictive control was implemented. Many of these strategies utilize the fuel rate signal as a controller cost function parameter. By using fuel rate, current control strategies have limited applicability to non-conventional powertrains. To maximize platooning adoption in modern, non-conventional powertrains, new parameters are being developed for platooning analysis. This study overviews results of the NMPC implementation for preservation of platooning efficiency benefits in the presence of grade based disturbances, overviews the development of a powertrain independent metric with which the platooning benefits can be analyzed.

Title: Artificial intelligence in the diagnosis, treatment, and prevention of Alzheimer’s disease

Primary Author: John Lange

Additional Authors: Muralikrishnan Dhanasekaran;Preston Cook;Keyi Liu;Suhrud Pathak; Courtney Alexander

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Alzheimer’s disease is the most common form of dementia in the elderly world-wide, which is described as an inherited and developed neurological disease that causes a steady decline in many types of brain functioning, including abstract thinking, memory, and motor control. This is due to the breakdown of cholinergic neurons in the central nervous system. Dementia is currently the seventh leading cause of death and one of the major causes of disability and dependency among older people globally. Due to the feared reputation it has developed, Alzheimer’s disease has taken a major toll on the financial and mental health of those diagnosed and their families. Alzheimer's disease has been challenging to diagnose, treat, and prevent, but recent developments have shown promise in these areas. Artificial Intelligence (AI) is a tool that has the potential to completely change how Alzheimer's disease is diagnosed, treated, and prevented. It is crucial to be able to make a diagnosis months or years before medical professionals are able to detect any physical changes, and AI has the ability to alter the future of medicine completely. Unlike gimmicks like ChatGPT or virtual assistants like Siri and Alexa, AI in medicine has the ability to completely change how the world is able to treat this disease state.

Title: Isolating the effects of individual nest characteristics in on offspring phenotypes of brown anoles

Primary Author: John Rodgers

Additional Authors: Daniel Warner;Chris Norris;

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: The influence of the external environment on offspring phenotypes and survival is well described for a variety of oviparous (i.e., egg-laying) species. Much of this previous work has focused on replicating natural incubation environments in the laboratory, based on the characteristics of maternally chosen nest sites in the wild. Although several environmental factors affect offspring phenotypes (e.g., substrate type, soil moisture, temperature), most studies do not assess the relative contribution of each factor to variation in offspring phenotype. To understand how multiple nest characteristics interact to affect offspring phenotypic variation, we studied the brown anole lizard (Anolis sagrei) and evaluated three major factors that typically vary among their nest sites: substrate type, incubation temperature, and soil moisture. Preliminary analysis suggests relatively moist soil increases egg mass during development at a greater rate than other treatments. Egg mass has a direct effect on hatchling body size, which is a primary driver of fitness variation in juvenile lizards. Further analyses will be conducted to isolate the effect of each environmental parameter on offspring phenotypes, and to determine which factor- substrate type, incubation temperature, or soil moisture- has the largest impact on hatchling body size and other morphological traits.

Title: Inducing diodic fluid behavior via the application of a hydrophobic coating onto a hydrophilic substrate to prevent rewetting

Primary Author: John Thornhill

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Paper drying is one of the largest industrial uses of energy resulting in significant efforts to improve efficiency. One energy saving method currently used in industry is applying pressure to the wet paper via rollers covered in a hydrophilic felt, but this results in rewetting, the flow of water back into the paper once the pressure is relieved. A proposed solution is to engineer the felts to promote diodic fluid behavior in the felts, allowing the water to pass through easily in one direction under pressure, but not the other way. We hypothesize that applying a thin layer of hydrophobic polymers to the felt will create the desired effect. Preliminary studies suggested that when the hydrophobic side of the substrate is exposed to water, a larger pressure can be sustained before water starts flowing compared to when the hydrophilic side is exposed. We investigated the application of high-intensity polystyrene (HIPS), Styrene-butadiene-styrene (SBS), and high-density polyethylene (HDPE) of varying concentrations to blotter paper using a doctor blade to apply an even coating of each polymer. Comparing the difference between the breakthrough pressures when the polymer coated side is oriented on the bottom verses on the top will allow up to determine which polymer exhibits the best diodic fluid behavior. After the best fit polymer has been determined, the polymer application process options will be characterized and compared to determine the best fit application process. With the chosen polymer, polymer thickness, and application process, the next phase of the project will involve coating a felt used in industry and running pilot scale tests to determine the amount of water saved from the polymer coating.

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:

Title: Controlling a Hybrid-Exoskeleton

Primary Author: Joseph Crapet

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Neurological conditions (NC) affect millions of Americans and often reduce the quality of life for those afflicted by causing decreased muscular strength, limb control, and range of motion. These conditions can lead to secondary health conditions such as obesity, muscle atrophy, and other chronic conditions. Common recreational exercises involve stationary bikes and reaching activities. Unfortunately, those with NCs may not have sufficient strength or motor control to effectively perform the actions necessary to achieve the training effects. Neuromuscular electrical stimulation (NES) promotes enhanced bone density, muscle development, and motor control for individuals with NCs [1]. Performing high-intensity actions repeatedly with NES can provide sensory afferent feedback; however, the individual's endurance levels limit NES-based training. Rehabilitation robots can overcome these limitations and have demonstrated the ability to improve the user's motor functions and sensory perceptions [1]. Hybrid exoskeletons combine the advantages of NES with rehabilitation robots to effectively help those with NCs. Our project aims to design and construct a hybrid exoskeleton that will act as a prototype concept for future studies. It will contain two degrees of freedom, which will allow the participant to bend at the elbow and rotate at the shoulder. The NES of the device will eventually be controlled using simple control principles. The user experience will also be incorporated into virtual reality to help motivate the connection between the user's brain and their actions using simple controls. Ultimately, the device will help the participants achieve arm flexion and extension. The participant's performance will be logged throughout the session and evaluated after the session. This process will be repeated over an extended period to determine the participant's growth.[1] F. Anaya, P. Thangavel, and H. Yu, "Hybrid FES–robotic gait rehabilitation technologies: a review on mechanical design, actuation, and control strategies," Int. J. Intell. Robot. Appl., pp. 1–28, (2018).

Title: The Impact of Increased Financial Literacy Education and Awareness Through Marketing Approaches

Primary Author: Joseph Luria

Additional Authors:

Department/Program: HCOB

College: Harbert College of Business

Abstract: I have been interning at Extension Alabama, an organization attached to Auburn University and Alabama A&M University promoting the use of a financial resource management program titled Alabama FAST: FAFSA (ALFAST) for incoming college students. My research problem dealt with how prospective college students are not often aware of financial aid opportunities available to them. My research can help increase their awareness of these financial aid opportunities and take advantage of the programs available to them. This project primarily aimed to leverage business marketing techniques to expand and analyze Human Sciences Extension's ALFAST program. The purpose of this research is to experiment with applied research on the principal, statewide initiatives delivered through Extension AL. My research is geared towards increasing awareness, analytics, and testing efficacy of the ALFAST program using marketing approaches. I have collected data on schools in Alabama and the kind of programs they are interested in from Extension AL. All members of the community desire to increase their financial literacy but do not often have the means to obtain it. From this research, I built skills in executing a marketing campaign that incorporates various forms of business marketing approaches including content marketing (e.g., social media, email marketing, and advertising), brand management/analysis, and public relations. As I have yet to examine official results, it appears that using marketing approaches has paid off for Extension's promotion of ALFAST and that they will continue to create promotions similar to what we have been publishing to increase the reach of their programs. Now that this research has been conducted and Extension has seen the results, they can troubleshoot previous and future marketing campaigns to more effectively promote the use of their programs such as ALFAST.

Title: Intraminority Stressors and How They Affect Body Dissatisfaction amongst Different Racial Groups.

Primary Author: Joseph Minh Le

Additional Authors: Tiffany Brown;Marley Billman Miller;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Epidemiological research suggests that sexual minority (SM) individuals experience greater body dissatisfaction compared to heterosexual individuals. Pressures to follow appearance ideas may stem from minority stress, or unique stressors related to one's sexual orientation from outside the LGBTQ community. They may also stem from intraminority stress, or status-related pressures from within the community. Still, little is known about how specific stressors or stress reactions experienced by SM individuals influence their body image concerns. Thus, our study assessed multiple SM stress-related constructs, including intraminority stress, internalized stigma, sexual orientation concealment (SOC), and harassment, and examined the relation between these constructs and body dissatisfaction in a sample of SM adults. Participants (n=350 SM cisgender men and women; n=165 White, n=98 Black, n=87 Asian) completed self-report measures of intraminority stress, internalized stigma, SOC, harassment, and body dissatisfaction at one timepoint. Pearson's correlations were used to examine associations between these constructs and body dissatisfaction within each racial group. Multiple linear regression models examined the main effects of these variables on body dissatisfaction for all groups. Results yielded no significant correlations between harassment and body dissatisfaction among Black individuals; however, Black individuals were the only ones that showed significant correlations between body dissatisfaction and intraminority stress. Regression models yielded significant main effects for SOC for the Asian subgroup, intraminority stress for the Black subgroup, and internalized stigma for the White subgroup. These findings suggest that SM stressors may differentially contribute to body dissatisfaction based on one's racial identity. Future research should continue to explore pressures from within the LGBTQ community to better understand drivers of body dissatisfaction.

Title: For the next generation: A review of nutritional programs to combat childhood obesity

Primary Author: Joshua Baskaran

Additional Authors: Linda Gibson-Young;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: This study investigates the efficacy of health and nutrition education programs in primary and high schools concerning overweight or obese children. Childhood obesity has become a significant public health issue worldwide, with detrimental consequences for physical and mental health. Schools have been identified as key settings for implementing interventions, such as health and wellness programs, targeting children's health behaviors. However, the effectiveness of these programs, particularly concerning overweight or obese children, remains uncertain.A comprehensive literature review was conducted to identify studies examining the impact of health and nutrition education on overweight or obese children in primary and high schools. Studies encompassing various educational interventions, including curriculum-based programs, extracurricular activities, and school-wide initiatives, were analyzed. Key outcomes assessed include changes in dietary behaviors, physical activity levels, body weight status, and knowledge of nutrition and health.Findings from the literature review suggest mixed results regarding the effectiveness of health and nutrition education for overweight or obese children. Some studies report positive outcomes such as improvements in dietary habits, increased physical activity, and modest reductions in body weight. However, other studies demonstrate limited or no significant impact on children's health behaviors or weight status. Factors influencing program effectiveness include program duration, intensity, delivery methods, parental involvement, and environmental support within schools.The variability in findings underscores the complexity of addressing childhood obesity through educational interventions. While health and nutrition education hold promise as preventive measures, additional research is needed to identify best practices and optimize program effectiveness. Tailoring interventions to the unique needs and preferences of overweight or obese children, along with addressing environmental influences, may enhance outcomes.

Title: Modeling imbibition of hydrogel coated seeds

Primary Author: Joshua Green

Additional Authors: Jean-Francois Louf;Tori Phillips;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Plant species that grow naturally in semi-arid environments have developed various survival strategies to capture water. One of them is to produce mucilage: a hydrogel seed coat that absorbs soil moisture and helps to maintain hydration in case of drought events. Inspired by these mucilage producing seeds, hydrogel coatings have been developed to improve drought resistance in other seed species. Some field tests showed encouraging results with, for example, increased growth by 16 percent in wheatgrass, 50 percent in cucumber, 77 percent in corn, and 100 percent in pea shrub. However, other tests showed conflicting results as the seed coatings reduced germination rates, especially with thin seed coats (hydrogel mass < 50%%20of seed mass). Unfortunately, the reason behind the dichotomy of these germination rates is unknown. To investigate the effect of a hydrogel seed coat on water transport, we designed artificial seeds made of clay and coated them with an alginate hydrogel. We then measured the associated imbibition rate and examined how the variation of permeability in flow direction, in this spherical geometry, affects the dynamics of water moving into the clay core. We found that the hydrogel coating did not delay imbibition of the clay core, and the flow dynamics could be captured by the Lucas Washburn theory, which can also be used for modelling imbibition of uncoated soy. We then successfully confronted our model with experiments conducted on natural soy seeds. Further, we tested the germination rate of our coated soy seeds and observed that the seeds coated in the hydrogel had less yields, but those that did grow had a larger root system. The hydrogel coated seeds that did not germinate were in the beginning stages of decay, which indicates the environment surrounding the seed was overly saturated with moisture. Together, our results provide further clarity on the reasons behind the conflicting yields reported when coating seeds with hydrogel.

Title: PhuzzyPhase: A diploid and polyploid phasing tool with genotype correction for HiFi and HiC data.

Primary Author: Joshua Horton

Additional Authors: Weerakoon Weerakoon;William Heaton;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Accurately haplotype phasing both diploid and polyploid genomes is necessary for getting a precise understanding of organisms' genomes, which is important to build humanity's understanding of ourselves and other organisms. Pacific Bioscience's circular consensus sequencing technology (CCS or HiFi) has revolutionized modern genomics by producing long (10 kb) and highly accurate reads by sequencing circularized DNA molecules multiple times and combining them into a consensus sequence. Additionally, chromosome conformation capture technologies such as Hi-C provide extremely long-range genetic information valuable for haplotype phasing. Here we present Phuzzyphase, a tool using these data types and Bernoulli mixture model clustering to accurately phase both diploid and polyploid genomes. This tool was able to phase human data with an extremely large N50 phaseblock, 20 short switch errors (0.00095%), 72 long switch errors (0.0034%), and fully phase most genes. This low error rate will allow us to potentially make corrections to vital gold standard genomic resources such as the Genome in a Bottle Consortium (GIAB), which is vital for deciphering complex genetic relationships and better understanding personalized medicine approaches.

Title: 3D-Printed oral films in addressing pediatric nonadherence in medications with applications in pediatric antiepileptic treatment

Primary Author: Joy Massey

Additional Authors: Allison Chung;Jayachandra Ramapuram;Chu Zhang;Nur Mita;Manjusha Annaji;Isha Patel;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Patient non-compliance is a top reason for non-adherence to medication, especially in the pediatric population. This is due to the administration difficulties to traditional oral dosage forms: tablets and capsules. Moreover, palatability concerns and poor aesthetics can deter pediatric adherence . Oral films (ODFs) are a developing oral dosage form that could address these issues. Oral films are ideal for this population because they do not require water with administration and use polymers to disintegrate rapidly upon contact with saliva. Most oral dosage forms go through first-pass metabolism, whereas in contrast, oral films adhere to the oral mucosa, or they can rapidly dissolve in the mouth, facilitating absorption and intake. ODFs are advantageous because they provide quick systemic absorption like the intramuscular route but are pain-free, like capsules and tablets. A step further, 3D-printed oral films are an upcoming dosage form that could incorporate optimization by personalizing medication, including unique shapes and colors without any harm. Moreover, anti-epileptic therapy was explored in the project; The nature of this dosage form will not only aid in adherence but is convenient for carrying and administering for pediatric patients experiencing a seizure. In both clinical and hospital settings, this dosage form can be beneficial. Our project focuses on optimizing 3D-printed drug-loaded oral films using water-insoluble polymer. A pneumatic extrusion printing technique was utilized for drug-loaded semisolid feed through a needle/nozzle utilizing air pressure. This technique offers fast fabrication of an oral film. 3D printed films were loaded with lorazepam. Oral films are primarily composed of film-forming polymers. Lorazepam is almost completely insoluble in water, thus, water-insoluble polymers including chitosan were explored to effectively load the drug. Moreover, natural polymers like Xanthan Gum were explored; both polymers are promising in the ODF industry. The fabricated films will be further tested for appearance and drug-release properties.

Title: Exploring TDP-43 in Neurodegeneration: Insights into Aggregation, Cellular Localization, and Impact on Neuronal Spines

Primary Author: Joyal Xavier

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: TAR-DNA-binding protein 43 (TDP43) is a pathologic marker in neurodegenerative diseases, including frontotemporal lobar degeneration and amyotrophic lateral sclerosis. The aggregation of TDP-43, a crucial RNA-binding protein, is a consequence of post-translational modifications (PTMs) that disrupt its normal function. PTMs such as phosphorylation and ubiquitination contribute to the aberrant accumulation of TDP-43 aggregates, leading to neurodegenerative disorders like amyotrophic lateral sclerosis (ALS) and frontotemporal lobar degeneration (FTLD). The enzymes that are involved in the cleavage of TDP-43 are caspases, asparaginyl endopeptidase (AEP), and calpain. And due to this cleavage, this protein leads to the formation of C-terminal fragments, which are the main cause of clumping, along with full-length TDP-43, to form aggregation in the nucleus, mitochondria, and cytoplasm of the neurons, which ultimately leads to the degradation of the cells. Hence, we observed the levels of TDP43, pTDP-43, and cTDP-43 in cells exposed to an acidic environment or sodium arsenate. However, under acidic conditions and following sodium arsenate exposure, we observed an increase in pTDP-43 levels as well as cTDP-43 in the mitochondria and nucleus when compared to normal media. The levels of pTDP43 in the mitochondria and nucleus decreased following compound 11 (AEP inhibitor) treatment in the acidic medium or sodium arsenate. Alternatively, our focus is to check how TDP-43 is affecting the formation of spines in the neurons. Furthermore, isolate exosomes from the cells and check the levels of TDP-43 to compare between normal and treated conditions. Findings from these studies are essential for developing targeted therapeutic strategies to mitigate neurodegenerative diseases associated with TDP-43 pathology.

Title: Social Media – A Reliable Place for Sleep Advice? Evidence for the Accuracy of Sleep Tips from Content Creators

Primary Author: Joycelyn VanAntwerp

Additional Authors: Brian Gillis;Emily Scott;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Trends show the public looks to social media for health advice. In a large survey, adults listed social media as their second place for health information, and most individuals reported that they do not verify the accuracy of information with a healthcare provider. Given the public's confidence in health advice shared on social media, it is important that content creators share medically sound advice. To that end, we sought to understand the scientific evidence supporting sleep tips shared on a social media platform. We transcribed the most-viewed videos on November 15-16, 2023, that used the tag #sleephacks, #sleephygiene, or #sleeptips. Two researchers coded each video to identify sleep tips; a third researcher coded >25% of videos for validity. A total of 295 sleep tips (including repeated tips) were coded across 58 videos. Tips were then organized by theme and compared to findings from empirical articles in peer-reviewed journals. Research-based evidence in support of sleep tips was defined as shorter sleep latency, longer sleep duration, more slow-wave or REM sleep, higher sleep satisfaction, or less daytime sleepiness in randomized or non-randomized controlled trials or correlational associations. N = 35 unique sleep tips were identified, grouped around 7 themes: calming activities (e.g., breathwork), use of electronics (e.g., limiting screen time), environment (e.g., cool air), foods/substances to avoid (e.g., caffeine), foods/substances to use (e.g., magnesium), schedule (e.g., consistency) and other sleep-related behaviors (e.g., mouth taping). Of the 35 tips, we found empirical support for 33, of which 26 had evidence from randomized controlled trials, 2 were supported by controlled trials without randomization, and 5 were backed by correlational associations. While much of the health advice shared on social media remains unreviewed by health professionals, current information about sleep hygiene and environment is generally backed by scientific support.

Title: The potential of artificial intelligence for uncovering the prevalence of and preventing neuroinfectious diseases

Primary Author: Juan Rodriguez

Additional Authors: Caleb Alford;Preston Cook;Keyi Liu;Muralikrishnan Dhanasekaran;Courtney Alexander;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Artificial Intelligence is revolutionizing the field of medicine. This technological advancement has the potential to help in the treatment, prevention, and diagnosis of infectious diseases that encompass the human and animal central nervous system (brain and spinal cord). Some of these neuroinfectious diseases caused by bacterial or viral infections include meningitis, encephalitis, progressive multifocal leukoencephalopathy, neurosarcoidosis, and transverse myelitis. These communicable diseases exhibit multiple symptoms that can lead to cognitive disabilities, movement disorders, psychological disturbances, or even death. In the treatment of these (CNS) infectious diseases, clinicians utilize different treatment approaches, including immunotherapy, antibacterial, antiviral, and anti-inflammatory medications. However, many of these central nervous system (CNS) associated diseases have poor prognoses and lack a definite cure. Therefore, knowing the importance and impact artificial intelligence could have on improving patient care and overall health outcomes, refining, and remodeling its functions to provide an early diagnosis, and minimize symptoms and prevalence of neuroinfectious diseases among our population, is a priority. In doing so, the development of ultra-precise procedures and measurements supported by artificial intelligence could ultimately ensure a decrease in morbidity, mortality, and healthcare costs through technological and financial advancement in diagnostics and preventative measures.

Title: Race-based biases in psychological distress judgements

Primary Author: Jules Wideman

Additional Authors: Jonathan Kunstman;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Racism and other health inequities create unique mental health challenges for Black Americans (e.g., DeVylder et al., 2020; Eboigbe et al., 2023). Paradoxically, despite encountering more health stressors, evidence suggests that people including mental health professionals believe psychopathology is less distressing to Black relative to White individuals (Kunstman et al., 2024).Building on this work, we tested whether the minimization of Black individuals' distress related to negative attitudes toward racially conscious mental health resources. We predicted that participants would assume the same mental illnesses would harm Black individuals less than White individuals. The judgments of targets were expected to inform evaluations of mental health resources. Participants judged Black and White targets' expected psychopathology-related distress and attitudes toward mental health resources. Paired samples t-tests revealed that participants judged Black individual to experiences less distress than White individuals. Regression analyses indicated that judgements of Black individuals' distress positively related to attitudes for mental health programs. The more participants minimized Black individuals' distress, the more negative participants' attitudes toward culturally competent mental health resources for Black Americans. These results provide evidence that racially biased judgements extend beyond evaluations of Black individuals to shape beliefs about mental health resources and pushes for health equity.

Title: Examine the effectiveness of an orexin 2 receptor (OX2R) agonist on memory, anxiety, and depression in narcoleptic orexin knock-out (OX-KO) mice

Primary Author: Julia Peterson

Additional Authors: Daniel Kroeger;Henry Limbo;Danielle Forbus;Vander LeKites;Natasha Wendy Grabau;

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 the following primary symptoms: severe sleepiness during the day, fragmented sleep during the night, hypnagogic hallucinations, and cataplexy. The secondary symptoms include memory impairments, anxiety, and depression. Current therapies utilize stimulants or antidepressants to enhance wakefulness to address the primary symptoms, but symptoms rarely fully resolve. Orexin knock-out (OX-KO) mice are exemplary because they lack the gene that encodes the protein prepro-orexin, resulting in a loss of orexin signaling and symptoms of narcolepsy. Previous research utilizing OX-KO mice demonstrated that an orexin agonist targeting the orexin 2 receptor (OX2R) could be used as an effective treatment for the primary symptoms of narcolepsy. The current study was designed to test whether this OX2R agonist can also alleviate the secondary symptoms of narcolepsy (impaired cognition, increased anxiety, and depression) in OX-KO mice. To assess the efficacy of our OX2R treatment we used three groups of 12 OX-KO mice (and three groups of 12 wild-type control mice). One group of each genotype received the OX2R agonist treatment, another vehicle treatment, and the third received Modafinil (a current narcolepsy treatment). One hour after administration, we assessed performance in the novel object recognition test (memory), open field test (anxiety), and forced swim test (depression). We hypothesized that the OX-KO mice treated with the agonist would perform at comparable levels to wild-type and Modafinil-treated mice in the object recognition test and show similar levels of anxiety and depression, but that vehicle-treated OX-KO mice would perform poorly compared to the other groups, confirming that OX2R agonist treatment can alleviate the primary as well as secondary symptoms of Narcolepsy.

Title: The Distinct Antitumor Selectivity of Novel Pan-RAS inhibitor ADT-007 in Pancreatic and Colorectal Carcinoma Models

Primary Author: Junwei Wang

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: KRAS mutations occur in over 90 percent of patients diagnosed with pancreatic adenocarcinomas (PDAC). These gain-in-function mutations activate KRAS to induce MAPK/AKT signaling, which is responsible for driving pancreatic cancer cell proliferation and other aspects of tumorigenesis. KRAS-G12D, KRAS-G12V, and KRAS-G12R mutations are the most common KRAS mutations in PDAC. However, KRAS inhibitors recently approved by the FDA were designed to only target KRAS-G12C, which only occurs in 3%%20of PDAC, leaving 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, demonstrated a potent inhibition of pancreatic cancer cell proliferation in vitro with single-digit nM IC50 values and suppressed RAS activation and MAPK/AKT signaling. ADT-007 presented a unique mechanism of selectivity for RAS mutant cancer cells without significantly affecting the proliferation of normal epithelial cells or cancer cells with wild-type (WT) RAS. We hypothesize the mechanism is due to either the RAS mutant cancer cells to be addicted to RAS for their growth and therefore highly sensitive to our pan-RAS inhibitor and/or enzymatic detoxification of ADT-007 in normal cells via glucuronidation. Currently approved KRAS-G12C inhibitors are also susceptible to resistance mechanisms, such as activation of WT RAS or secondary RAS mutations. Due to its pan-RAS inhibitory activity, ADT-007 is expected to have greater efficacy and reduced susceptibility to mechanisms of resistance. A prodrug of ADT-007 (ADT-1004) exhibited a 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: Determining the factors that influence algal symbiosis with nitrifying bacteria

Primary Author: Justus Smith

Additional Authors: Brendan Higgins;Wellington Arthur;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Interactions between nitrifiers and algae are understudied in the context of applied systems with high total ammonia nitrogen (>100 mg/L). Some research suggests that algae can dramatically increase the rates of bacterial nitrification and the abundance of populations. Robust nitrification is important for engineering applications such as wastewater re-use for irrigation of hydroponic crops. However, the mechanisms of this relationship remain largely unexplored. We hypothesized that algae benefit nitrifying bacteria through both the supplementation of oxygen and the secretion of beneficial chemicals. Batch cultures of nitrifying cultures from municipal activated sludge were grown on sterile-filtered poultry processing wastewater, with three treatments in triplicate: addition of growth of live algae, remaining medium from sterile-filtered algae cultures (referred to as algal photosynthate), or 40% O2 aeration. Experiments were performed with two separate strains of the algae *Chlorella sorokiniana*. Cultures with added algal photosynthate displayed a more complete conversion of ammonia to nitrate than control cultures and cultures with live algae. However, cultures with live algae removed more ammonia overall but did not produce much nitrate (<5 mg/L). Cultures with added algal photosynthate also displayed more complete nitrification than cultures supplemented with oxygen, contrasting with the prevailing hypothesis that algae aid nitrifying bacteria through oxygen provision. Further work is being done to see if these findings are consistent in wastewater with higher TAN concentrations (>200 mg/L), as well as using sequencing to characterize change in nitrifying populations. The end results will provide a better understanding of nitrifier-algae interactions, which will be useful in evaluating the potential addition of algae to the wastewater treatment process.

Title: More intimate couples' sleep position is indirectly related to lower couple avoidant attachment through lower couple perceived stress.

Primary Author: Kaleigh Miller

Additional Authors: Joshua Novak;Kate Day;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Recent research on couples' intimate sleeping position "cuddling" suggests a benefit to relationship satisfaction and that this affectionate touch during sleep onset may also improve mood and stress. Importantly, however, this initial research has relied on only individual reports—compared to both partners' reports—and has yet to link it with relational processes amenable to intervention. Utilizing dyadic data from 143 mixed-gender bed-sharing couples, the present study investigated associations between couples' sleep position at onset, perceived stress, and avoidant attachment. To account for the shared variance between partners in sleep position, stress, and attachment, we utilized the Common Fate Mediation Model (CFMeM) in Structural Equation Modeling (SEM). We also included daytime sleepiness, income, age, relationship length, if children or pets sleep in bed, and sleep diagnoses as important covariates and compared our model to two plausible alternative ordered models. Results revealed that more intimate couple-level sleep positions are indirectly linked with lower couple-level avoidant attachment through lower couple-level perceived stress. Although the present data were cross-sectional, cuddling at the onset of sleep may benefit couple relationships by decreasing both stress and avoidant attachment. Future research should utilize daily diary methods to confirm these results.

Title: Trends and Factors Affecting the Initiation of Denosumab and Zoledronic Acid among Patients with Metastatic Lung, Breast, and Prostate Cancer in the United States

Primary Author: Kaniz Afroz Tanni

Additional Authors: Jingjing Qian;Pei Xu;Salisa Westrick;Surachat Ngorsuraches;Nedret Billor;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Patients with Metastatic lung, breast, and prostate cancer (MLBPC) experience skeletal related events (SREs), which significantly decrease survival. Denosumab (DS) and Zoledronic acid (ZA) are recommended for these patients to prevent such SREs. However, there is a lack of evidence in the patterns and predictors of real-world initiation of DS versus ZA in older MLBPC patients in the United States. The objective of the study was to examine the trends and factors associated with DS or ZA initiation among older MLBPC patients in the US. We used the Surveillance, Epidemiology, and End Results (SEER)-linked Medicare data to identify patients diagnosed with MLBPC between 2012 and 2017 who initiated DS/ZA treatment within 12 months of cancer diagnosis. Demographics, healthcare utilization, comorbidities, disease, and treatment attributes of new users were evaluated. Trends in treatment initiation were assessed using Cochran-Armitage tests among all MLBPC patients and by cancer type. T-tests, Chi-squared tests and multiple logistic regressions were employed to identify factors influencing the choice between DS and ZA initiation. In 2012-2017, DS initiation trends increased across all individual cancer cohorts as well as the overall MLBPC sample, while ZA initiation notably decreased in the metastatic breast cancer and MLBPC cohorts (all $P<0.0001$). Patients more likely to initiate DS over ZA were older at diagnosis, Hispanic, single, eligible for low-income subsidies, urban residents, had multiple comorbidities, impaired renal function, and prior chemotherapy use. There are significant differences between the trends in DS and ZA initiation as well as in the factors affecting initiation among MLBPC patients.

Title: Assessment of fungicide application and cultivar selection on areolate mildew and target spot on Alabama cotton

Primary Author: Karamjit Kaur Baryah

Additional Authors: Hunter Mote;Katherine Burch;Amanda Strayer-Scherer;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Areolate mildew (AM; *Ramularia spp*.) and Target spot (TS; *Corynespora cassiicola*) are two of the most economically damaging cotton diseases in Alabama, which can cause income losses between \$150/A and \$375/A in susceptible cultivars, respectively. In 2023, two research trials were established at the E.V. Smith Field Crops Unit in Shorter, AL to evaluate the impact of cultivar selection and fungicide application on disease severity and yield. The cultivar trial was a split-plot design with cultivar (n= 9) as the main plot and fungicide treatment (treated vs. nontreated) as the sub-plot. The fungicide application trial used cotton variety ‘DP 1646 B2XF’ and had 15 fungicide treatments arranged in a randomized complete block design. In 2023, AM and TS pressure were low due to dry weather across the cotton belt. TS was not observed in either of the trials. However, the statistics concluded that ‘DP 1646 B2XF’ had significantly higher AM severity when compared to all remaining cultivars, except for ‘DP 2127 B3XF’. Fungicide applications only significantly mitigated the AM's severity for ‘DP 1646 B2XF’ and ‘DP 2127 B2XF’. For the fungicide application trial, only Revytek at 12 fl oz/A in the 5th week of bloom and Quadris at 8 fl oz/A in the 1st and 3rd weeks of bloom significantly reduced AM severity when compared to the nontreated control. Fungicide applications did not significantly impact yield in either trial. This study demonstrates that cultivar selection and fungicide applications are effective tools for avoiding damaging outbreaks of AM.

Title: Nodulation of soybean by rhizobia with varying ACC deaminase activities

Primary Author: Kasun Thilina Wanninayaka Lansakara Jayasundara

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

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: 1-Aminocyclopropane-1-carboxylate (ACC) is the immediate precursor of the plant stress hormone ethylene, acting as a key regulator in both plant growth and stress responses. ACC deaminase is an enzyme found in soil bacteria, including rhizobia, that is responsible for breaking down ACC. As a result, the inhibitory effects of ethylene in plants are reduced particularly during stress periods. Soybean is more susceptible to drought stress compared with other legume crops. High ACC deaminase activity in its rhizobial symbiont may be beneficial under drought stress. The objectives of this study were to screen rhizobia isolated from soybean nodules for ACC deaminase activities and assess the capability of selected isolates to reinfect soybean. We found that the ACC deaminase activities of 49 isolates varied from 0.34 to 3.53 μmol α-ketobutyrate/mg protein/h. The top five isolates with high ACC deaminase activities and the one with the lowest activity were selected to assess their nodulation and nitrogen fixation potential in soybeans using Leonard jars in a growth chamber. These isolates were identified as *Bradyrhizobium* sp. based on 16S rRNA gene sequencing. After one month, all inoculated plants produced nodules, while uninoculated ones did not. Plants inoculated with two of the five isolates with high ACC deaminase activity appeared yellow, probably due to lack of nitrogen despite nodule formation. Analysis of variance performed on plant physiological parameters revealed significant differences among inoculation treatments ($p < 0.05$). Only one of the two isolates with the highest ACC deaminase activity had a higher nodule number and nodule dry weight than the isolate with the lowest ACC deaminase activity. Further experiments will be conducted in the greenhouse using these isolates to explore the role of rhizobial ACC deaminase in alleviating drought stress on soybean.

Title: Optimizing colonization and proliferation of blue (I. furcatus) and channel catfish (I. punctatus) stem cells in white catfish (A. catus) triploid fry

Primary Author: Kate Pottle

Additional Authors: Rex Dunham;Barrett Chambers;Hamza Dilawar;Misha Soman;Mei Shang;Baofeng Su;Darshika Udari Hettiarachchi;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: As xenogenesis techniques continue to develop for the hybrid catfish industry, expanding both host and donor options to find the optimal xenogen is an ongoing goal. Past studies have focused on utilizing the traditional channel x blue cross for xenogen development. This study asses the feasibility of utilizing the white catfish as a host species for xenogen production while also analyzing optimal stem cell quantity for proliferation and colonization. Triploid white catfish fry were injected with either blue catfish stem cells (BSCs) or channel catfish stem cells (CSCs) labeled with PKH26 dye at 4-6 days post-hatch (DPH) with either 80,000 or 100,000 cells/fry. At 45 and 90 DPH, growth performance (total length [TL] and body weight [BW]), survival of recipients, and colonization/proliferation of donor cells were evaluated (cell area <150 µm2 / cluster area >150 µm2). PCR was also used to determine the percentage of xenogens from gonad samples. Quantity of stem cells injected had no significant impact on survival for both BSCs ($P \geq 0.855$) and CSCs ($P \geq 0.752$). Some variation could be seen in TL and BW for both BSCs and CSCs which can be explained by stocking density variation. At 45 DPH, cell area for BSCs ($P > 0.132$) and CSCs ($P < 0.004$) and cluster area for BSCs ($P < 0.001$) and CSCs ($P < 0.001$) demonstrated increased proliferation and colonization in hosts injected with 100,000 cells/fry compared to those injected with 80,000 cells/fry. Similarly, at 90 DPH, a significant increase in cell cluster area in recipient BSCs and CSCs transplanted fish was seen ($P < 0.048$

Title: Phonological Complexity and Accuracy in the Spontaneous Speech of Young Children who Stutter

Primary Author: Katelyn Gilson

Additional Authors: Katie Wallace;

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: Theories have proposed that linguistic demands, and/or deficits in phonology, may place additional pressures on an unstable speech motor system, which might lead to breakdowns in speech. This has also been corroborated by reports that children who stutter, as a group, exhibit weaker articulatory proficiency, utilize cluster reduction more frequently, and have greater difficulty acquiring consonant clusters. The current study examined whether children who stutter exhibit poorer phonological skills as measured by phonological mean length of utterance (PMLU) and proportion of whole-word proximity (PWP), which index phonological complexity and phonological accuracy, respectively. The results of this study will further our understanding of phonological abilities that might exist between children who stutter and children who do not stutter.

Title: Drinking with my friends: The impact of social media use on alcohol consumption and mental health.

Primary Author: Katelyn Mandeville

Additional Authors: Emme Lewandowski;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Alcohol consumption in young adulthood has been linked to a variety of negative consequences, including disruption of sleep quality, higher rates of depression, and increased anxiety. Social factors, such as the perception of peer norms, play a role in heavier alcohol consumption among college students, but the impact of social media is less clear. Social media use has become a central part of many students' lives; thus, this research explores how it might influence alcohol consumption and, in turn, student well-being. Furthermore, Fear of Missing Out (FoMO) could potentially be a driving factor in both consumption of social media and alcohol. Thus, this research will explore these potential connections. In the fall of 2023, a survey was distributed using Qualtrics, in which participants ($n = 701$) consisted of Auburn University undergraduate psychology students. The use of alcohol was measured using two scales, including the AUDIT, which is more focused on alcohol consumption, and the B-YAACQ, which explores the consequences of alcohol use. The results showed that a higher frequency of checking social media was predictive of negative alcohol consequences ($F(1,674) = 21.21$, $p < 0.001$, with an R-squared of 0.031). In turn, the presence of negative alcohol consequences (i.e., hangover, blackout, etc.) was correlated with many negative mental health experiences such as depression ($r = 0.163$), anxiety ($r = 0.140$), low subjective happiness ($r = -0.092$), and high perceived stress ($r = 0.166$). Additionally, both negative alcohol-related consequences ($r = 0.287$) and heavy alcohol use ($r = 0.245$) were associated with poor sleep quality, indicating alcohol use can impact physical health. Furthermore, we found that FoMO showed significant relationships between both AUDIT scores ($r = 0.133$) and B-YAACQ scores ($r = 0.221$), and students with higher FoMO check social media more frequently ($r = 0.235$). These results suggest that social media use and FoMO indeed play a role in high-risk drinking behaviors.

Title: A synthesis of faculty perceptions and comfortability with artificial intelligence

Primary Author: Katelyn Stalboerger

Additional Authors: Kailea Manning;

Department/Program: Educational FLT

College: College of Education

Abstract: Artificial Intelligence (AI) is becoming an increasingly prevalent technology. This disruptive innovation is characterized by its radical impact and adoption in various industries, including in higher education institutions. AI's rise in popularity and use is accompanied by rising expectations for faculty members to quickly adapt to these changes, often with very little training. Training for faculty is essential to ensure they are equipped with the latest tools and resources to effectively educate their students. However, access to training, tools, and resources are often not provided to faculty through the institution. Because of this, many faculty members do not have the opportunity to learn about disruptive innovations, such as AI, and receive the necessary training to become comfortable with their utilization. This concern has been seen with disruptive innovations like cell phones and Google. With this knowledge, it is essential to study previous literature on past training developments and their shortcomings. This synthesis will help researchers and practitioners understand what types of training are successful and how the training should be implemented to ensure a high success rate. Further, it is imperative to study literature on the perceptions and comfortability of faculty members with past disruptive innovations such as cell phones to understand themes relevant to faculty perceptions and comfortability with AI. Through the completion of a literature review focused on faculty perceptions and comfortability with disruptive innovations, researchers will be able to better understand existing themes and how they might be applied to AI. A future follow-up study will consist of developing a survey to better understand current faculty perceptions and comfortability of AI and what, if any, existing AI training is being offered to faculty members.

Title: Immune cell development continues throughout the larval stage of the purple sea urchin

Primary Author: Katelynn Tucker

Additional Authors: Katherine Buckley;Tyler Smith;Megan Maloney;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Marine invertebrates live in a microbially-rich ecosystem in which they face constant immunological challenges. In response to this exposure, many marine invertebrates have evolved intricate defense systems mediated by dedicated immune cells. In adult sea urchins, immune responses are mediated by circulating cells known as coelomocytes. One subset of coelomocytes, known as red spherule cells, exhibits a bright red color due to the presence of the echinochrome A, a naphthoquinone with antimicrobial properties. Red spherule cells are morphologically and transcriptionally similar to pigment cells, which mediate immune responses in sea urchin larvae. Although the specification of pigment cells has been well-characterized during early embryogenesis, little is known about the formation and development of these cells beyond the late-gastrula stage. Preliminary evidence suggests that pigment cell number increases throughout the course of larval development, although the source of these cells is not known. Understanding pigment cell differentiation may elucidate their function during larval development and if these distinct cells contribute to adult immune responses. We therefore aim to quantify pigment cells during larval development in *Strongylocentrotus purpuratus*. Adult sea urchins will be spawned and fertilized, and larval culture will be maintained for two months. Weekly samples will be collected for microscope imaging and pigment cell quantification. Preliminary results suggest an increase in the number of pigment cells after 2 weeks. These results shed light on the development of the immune system in deuterostomes.

Title: The chromosome-scale reference genome for the pinfish provides insights into their evolutionary and demographic history

Primary Author: Katherine Eaton

Additional Authors: Moises Antonio Bernal de Leon;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The pinfish *Lagodon rhomboides* is an ecologically, economically, and culturally relevant member of family Sparidae, playing crucial roles in marine food webs of the western Atlantic Ocean and Gulf of Mexico. Despite their high abundance and ecological importance, there is a scarcity of genomic resources for this species. We assembled and annotated a chromosome-scale genome for the pinfish, resulting in a highly contiguous 785 Mb assembly comprised of 24 scaffolded chromosomes. The high-quality assembly contains 98.9 percent complete BUSCOs and shows strong synteny to other chromosome-scale genomes of fish in the family Sparidae, with a limited number of large-scale genomic rearrangements. Leveraging this new genomic resource, we found evidence of significant expansions of dietary gene families over the evolutionary history of the pinfish, which may be associated with the unique ontogenetic shift in diet seen in this species. We also estimated historical patterns of population demography using this new reference genome and identified several periods of population growth and contraction which were associated with ancient climatic shifts and sea level changes. This genome serves as a valuable reference for future studies of population genomics and differentiation and provides a much-needed genomic resource for this western Atlantic sparid.

Title: The Effect of Police Officer Protective Gear on Mobility, Stability and Power Generation

Primary Author: Katherine Frick

Additional Authors: Joellen Sefton;Christopher Brooks Mobley;Frances Neal;Nicholas Bordonie;Philip Agostinelli;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Protective gear is a critical part of the police officer uniform. The 9kg gear is cumbersome due to its rigidity and bulk, creating physical performance deficits. Mobility, balance, and power generation are essential to the completion of an officer's daily tasks. Few studies have assessed the effect of police protective gear on these important capabilities. Understanding the change in physical capabilities resulting from protective gear is critical to the safety and survival of the police officer. The purpose of this study was to evaluate the impact of protective gear on officer capabilities. Police officers from a medium-sized city volunteered for this study (male=68, female=4; ages 21-65). Officers completed an 11-point assessment evaluating power generation, balance, functional movement, and flexibility in two conditions: athletic attire (No Gear) and uniform protective equipment (Gear). Paired t-tests were conducted to evaluate police officers' movement capabilities in each condition. Balance testing analysis indicates officers in gear have significantly decreased stability in path length and mean velocity, but comparisons of standard ellipse areas indicated officers are able to compensate for this instability. Results indicate a significant decrease in performance in vertical jump height ($t71= 13.51$, $p>0.001$), power generation per kg ($t71=7.13$, $p>0.001$), modified pushup ($t71= 3.17$, $p=0.002$), overhead squat ($t71= 2.43$, $p=0.018$), and sit-and-reach length ($t71= 12.41$, $p>0.001$). Decreased physical capability in balance, mobility and power generation were apparent when comparing the "Gear" and "No-Gear" conditions. Decreased on-duty performance can affect officer safety and success. These results indicate the need for continued evaluation and improvement of police officer safety equipment to ensure mobility and safety.

Title: Engineering Bioplastics with Biopolymers and Antimicrobials to Improve Listeria monocytogenes Food Safety in Ready-to-Eat Foods Over 12-Weeks of Storage.

Primary Author: Katherine Sofia Sierra Melendrez

Additional Authors: Amit Morey;Laura Garner;Jakob Doster;Payten Leeds;Telah Black;Vianca Maite Tashiguano Encalada;Luis Jose Guzman Sabillon;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Food packaging's impact on environmental pollution concerns customers, pushing the food industry to adopt innovative, sustainable, and biodegradable plastic-alternative packaging (PAP). Using biomolecules from agricultural waste to improve mechanical properties and antimicrobials to improve food safety and shelf life in PAP can increase their market acceptance. Research was first conducted to develop a PAP with biopolymer from chicken skin; secondly to incorporate antimicrobials and study their effects on the mechanical properties of the PAP; and thirdly to evaluate the efficacy of the antimicrobial PAP against *Listeria monocytogenes* (LM) and spoilage of ready-to-eat (RTE) products. Bioplastic films with a base formulation of 3% Chicken Gelatin 4% Nanocellulose, starch (1%), glycerol (6%), and water (85%) were developed with either 0, 1, or 3% lactate diacetate (LD) as an antimicrobial. The LD was incorporated into the dried cast films. Mechanical properties were analyzed for tensile force, Young's modulus, elongation, and punching force. For antimicrobial analysis, films with three antimicrobial treatments (0, 1, and 3%) and one control treatment (without any packaging) were tested. RTE bologna was inoculated with ~6 logs of LM. The antimicrobial side of the film was laid on top of the inoculated deli surface, vacuum packaged, stored (4℃), and sampled weekly for 12 weeks (3 samples x 2 trials, n=240). Deli film was stomached (Buffer Peptone Water 1:1w/w, for 1 min), serially diluted, and spread plated (0.1 mL) on Modified Oxford Agar and incubated at 37 degree C for 24 hours. Data was analyzed (ANOVA with Tukey's HSD) with significant mean differences at $p<0.05$. The addition of LD to bioplastics with gelatin significantly reduced its mechanical properties. The LD bioplastic acted as a bacteriostat, a bactericide (decrease of ~2 logs CFU/g), and a bacteriostat for weeks 0-4, 5-7, and 7-12, respectively. This study's results show that LD-PAP offers a promising alternative for food packaging.

Title: Physical activity for anxiety for autistic people: A systematic review

Primary Author: Kathryn Riis

Additional Authors: Kristina Neely;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Clinical anxiety is a common comorbidity in autistic people. Due to the prevalence of anxiety in the autism population and the adverse effects it causes, there is a critical need to develop effective interventions that address anxiety symptoms for autistic people. Therefore, the purpose of this systematic review was to examine the effectiveness of the use of physical activity as an intervention to reduce anxiety in autistic people. Three databases PubMed, PsychInfo, and Cochrane RCTs, were searched utilizing key terms. PRISMA systematic search procedures identified 44 studies meeting predetermined inclusion criteria. Participant characteristics, the type of physical activity performed, the nature of the physical activity program/delivery, anxiety-related outcomes, and research methodology was evaluated for each study. Each paper included in the review was appraised and scored for risk of bias using Cochrane Handbook for Systematic Reviews of Interventions risk of bias tool. Titles and abstracts of 44 articles were reviewed and 8 articles met inclusion criteria which evaluated interventions. Evidence from 8 studies suggests that yoga, a community-based football program, an app-assisted walking program, group exercise programs, and a horseback riding intervention reduced anxiety for autistic people. The studies included in this systematic review provide strong-to-moderate evidence that physical activity can reduce anxiety for autistic children and adults. However, additional research is needed to identify which mode of physical activity is most beneficial for anxiety reduction. Further, future research should evaluate frequency, duration, and intensity and their effects on anxiety for autistic people.

Title: Strategic integration of zero-emissions landscape equipment: Results from a nation-wide survey

Primary Author: Kati Kent

Additional Authors: Beau Brodbeck;Mark Hoffman;Paul Bartley;

Department/Program: Horticulture

College: College of Agriculture

Abstract: The movement towards the electrification of the landscape industry is becoming more prevalent due to the legislative restrictions and advancements in battery technology. However, with the impending restrictions there is very little research into this area to aid landscapers in integrating. With the results from this survey, we hope to use their input in creating a guide to help landscape professionals make the switch. Beginning with company demographics, this gives us an insight into what makes up these companies. Reliability, work capacity, and availability are the top three concerns of landscape professionals when purchasing equipment in general. They want to be able to get the equipment and that that equipment will get their job done. Of all the respondents, 52% use battery-powered equipment in their businesses. Noise pollution, reliability, work capacity, and maintenance are the top three reasons that these company began adopting battery-powered equipment. Of the 48% that use gas-powered equipment, work capacity, power, and quality are the top reasons that those companies have yet to integrate into battery-powered equipment. Surprisingly, 70% of those who only use gas said that they would make the switch with 15% saying no and 15% being unsure. Landscape professionals want equipment that they can rely on and that will last long enough with enough power to get their jobs done.

Title: Evaluating the impact of COMPASS for Courage on 2nd and 3rd grade children's anxiety levels with college-aged mentors as a mediating factor

Primary Author: Katie Lawrence

Additional Authors: Linda Gibson-Young;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Anxiety impacts children of all ages in all circumstances. While interventions are frequently used on a case-by-case basis to assist students in navigating this disorder in school, few attempts have been made to address anxiety at a classroom level across various age groups. Research has indicated the promising impact of transdiagnostic preventative intervention methods that help individuals regardless of which diagnostic criteria they meet for anxiety. The purpose of this cross-sectional study is to address the deficit in anxiety interventions and treatment for clinical and subclinical anxiety in school-aged children. This will be accomplished by implementing a short-term interactive group anxiety education program called Our House for 2nd and 3rd grade children in an Auburn non-profit afterschool program. The specific emphasis of this project is the effectiveness of this kind of education on anxiety symptoms across the board, not just for those with diagnosed anxiety disorders or severely impaired cases. The question will test both the effectiveness of such education for this specific demographic of children in such a program and the mediating role that college-age volunteers can play in the program. A component of the research question is whether those volunteers actively participating in the program alongside the children will improve its effectiveness and the children's general retention of the material. This study will utilize the COMPASS for Courage curriculum from PBS, which has been extensively studied at Arizona State University and verified as a viable intervention for children struggling with anxiety. Results generated from this study will provide important information for afterschool programs, anxiety education instructors, mentor-based programs, and general children's anxiety intervention research in the future.

Title: Design and Development of Novel Trimethylamine-Oxide Inhibitor.

Primary Author: Katrina Schoenrock

Additional Authors: Rajesh Amin;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Recent investigation for understanding the mechanism by which altered gut-brain axis impacts the central nervous system has received significant attention. Dysbiosis is the alterations in the gut microbiome dementia, multiple sclerosis, and Parkinson's disease. In cognitively impaired elderly patients and in transgenic rodent models of Alzheimer's disease (AD), gut dysbiosis had significantly positive correlations with AD pathology including cerebral amyloid beta depositions. Trimethylamine N-oxide (TMAO), a hepatic metabolite, comes from the gut microbiota catabolism of dietary nutrients (primarily L-carnitine, choline, and phosphatidylcholine) into TMA, which is further converted into TMAO. Interestingly, higher levels of TMAO in circulation and cerebral spinal fluid (CSF) have been observed in diabetic patients and patients with Alzheimer's disease (AD) dementia. Recent findings have reported that TMAO promotes brain aging and cognitive impairment. Moreover, we have observed higher levels of TMAO in the brains of transgenic Alzheimer's disease mice. This TMAO has led to increased levels of oxidative stress in these mice, increasing amyloid beta and other markers of AD. However, there are currently no inhibitors for FMO3 available. Method: In the current study, we investigated the design and development of novel FMO3 inhibitors in silico using the Schrodinger computational modeling software. In our investigation, we discovered that the asparagine 78 residue is a highly conserved and important residue for FMO3 activity. From there we developed a library of compounds and discovered our lead compound. We then tested several of our synthetic compounds using FMO3 hepatic microsomes and transfected hepG2 cell lines. The development of this assay was critical for the advancement of our compounds. Our assay focuses on measuring the conversion of TMA to TMAO. We predict that we will see decreased levels of TMAO in the presence of our inhibitor. This research is significant for understanding diabetic pathology, such as gut dysregulation.

Title: Valuing some survivors over others: age effects in sexual violence

Primary Author: Kayleigh Garrett

Additional Authors: Sara Driskell;Halee Barbour;Lindsay Gardner;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Many college students and other young adults experience sexual violence. However, on college campuses, Title IX is designed to support these survivors. In recent years, Title IX regulations have gone back and forth over what these protections can entail, frequently leaving large gaps in coverage and support of young survivors. In contrast to this wavering support, laws are very firm for people who have committed sexual violence against minors, and even though there are still gaps in these systems, society is largely unified in how we perceive child sexual predators. We aimed to explore how a few short years can switch people's perceptions of survivors and what penalties are most deserved by their perpetrators in hopes of ultimately providing better support for survivors of all ages, demographics, and circumstances. In one study (MTurk, N=117), participants first read about varying motives in the justice system: revenge or punishment. Then after rating their agreement, they read a vignette about a rape that varied in the age of the person attacked: girl or young woman. As expected, participants wanted harsher penalties for the girl's assailant and even rated some penalties were unfair for the young woman's assailant. However, framing the justice system as being about revenge or punishment did little to override this effect. Next, we plan to evaluate important moderators for this effect, such as beliefs about protecting children's innocence and victim-blaming. This research is important for helping to support survivors of sexual violence regardless of age or other characteristics that limit the help they receive.

Title: Enhancing Polypropylene/Polyethylene Blend Performance through Formation of Microcrystalline Cellulose-Based Core-Shell Particles at the Interface

Primary Author: Ke Zhan

Additional Authors: Yucheng Peng;Thomas Elder;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Polypropylene (PP) and high density polyethylene (HDPE) frequently commingle in plastic waste and are challenging to separate due to similar density. Recycling them in the form of a blend is a cost-effective method. However, the inherent immiscibility limits the development of the blend with desirable properties. To enhance the performance of the PP/HDPE blend, microcrystalline cellulose (MCC) was incorporated with the assistance of maleic anhydride grafted polyethylene (MAPE). The PP/HDPE blend was manufactured with a weight ratio of 75:25, and MCC particles, ranging from 2.5wt.% to 30wt.%, were introduced through thermal compounding, with or without 5wt.% MAPE. Morphological observations revealed the formation of core-shell particles with MCC as the core and MAPE as the shell at the interface. The mechanical performance of the PP/HDPE blend was improved, benefiting from the stress-transfer capability of this unique MCC-based core-shell structure. Thermal analyses indicated that MCC acted as a nucleating agent, elevating the crystallization peak temperature of PP. However, this effect was hindered when MCC particles were encapsulated by MAPE. Rheological results exhibited heightened complex viscosity and storage modulus with increasing MCC content, indicating improved elastic behavior due to restricted chain movement. The introduction of MAPE resulted in a reduction in viscosity and modulus, likely attributed to a lubricating effect. Creep-recovery testing showed reduced creep and residual deformation, emphasizing MCC's role in restraining polymer chain mobility and improving rigidity. The formation of the core-shell structure after MAPE compatibilization further improved the creep resistance of the PP/HDPE blend. MCC-based core-shell particles demonstrated satisfactory results in improving the PP/HDPE blend performance.

Title: News media effects on counseling students' empathy and stigma

Primary Author: Keith Huffman

Additional Authors: Jinhee Park;Claire Hebert;Tori Young;

Department/Program: Counseling Leadership and Special Education

College: College of Education

Abstract: This study evaluated news media effects on counseling students' empathy and stigma toward incarcerated people with mental illness. After being randomly assigned to review an online news article that either positively or negatively depicted incarcerated people with mental illness, 121 counseling students enrolled in CACREP-accredited programs across the U.S. completed a survey that assessed their empathy and attitudes toward incarcerated people with mental illness. Findings revealed that the manners in which news media presented information significantly affected counseling students' empathy and attitudes toward incarcerated people with mental illness. Additionally, empathy significantly mediated the relationship between news articles and counseling students' attitudes toward incarcerated people with mental illness. Implications include the need for counselor educators and supervisors to educate counseling students about news media effects, thereby reinforcing respect for diversity and the acquisition of multicultural competencies.

Title: Building a global health clinic: A strategic business plan

Primary Author: Kendall McCallum

Additional Authors: Linda Gibson-Young;

Department/Program: Nursing

College: College of Nursing

Abstract: This poster presents a comprehensive business plan for the establishment of a Global Health Clinic, aimed at addressing healthcare disparities and promoting wellness on a global scale. The proposed clinic seeks to combine medical expertise and a commitment to social responsibility to provide accessible, high-quality healthcare services globally to underserved communities.The business plan outlines key components including market analysis, target demographics, service offerings, operational structure, financial projections, and sustainability strategies. By utilizing telemedicine platforms and mobile health units, the clinic aims to reach remote populations and bridge healthcare gaps.Strategic partnerships with local governments, non-profit organizations, and corporate sponsors will be vital in supporting clinic operations and expanding outreach efforts. The implementation of scalable business models and cost-effective healthcare delivery systems will ensure long-term viability and impact.The clinic's services will encompass preventive care, primary healthcare, specialty consultations, diagnostic testing, and health education programs. Multidisciplinary teams of healthcare professionals, including physicians, nurses, and specialists will collaborate to deliver comprehensive and culturally sensitive care.Financial projections demonstrate the clinic's revenue streams and growth potential. Funding sources may include grants, philanthropic donations, public-private partnerships, and fee-for-service models. Initiatives to promote health equity, cultural competence, and workforce development will foster community engagement and empowerment.In conclusion, the establishment of a Global Health Clinic presents a compelling opportunity to address global health challenges, improve healthcare access, and advance social justice. Through strategic planning, innovation, and collaboration, the clinic aims to make an impact on the well-being of individuals and communities worldwide.

Title: Association Between Basal Ganglia Substructures and Risk Taking

Primary Author: Kennedy Palmeira

Additional Authors: Samantha Fede;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: The basal ganglia are a set of brain structures that play a crucial role in motor control, executive function, and emotional behavior. Specific substructures have distinct roles related to value decisions and behavior. For example, previous studies suggest a negative association between nucleus accumbens (NAcc) grey matter volumes (GMV) and reward seeking/risk taking. The purpose of this study is to replicate these established relationships and to understand how specific types of risk impact these associations. Adult volunteers ($n = 37$) completed a social descriptive risk task and underwent a 7 Tesla magnetic resonance imaging structural scan (MPRAGE). In the task, participants had a binary choice between a safe (guaranteed small reward) or risky (large uncertain reward or loss) option. Trials varied based on who would receive the potential loss (self vs other). Freesurfer auto-segmentation was used to extract basal ganglia substructure GMV (caudate, pallidum, putamen, and NAcc). Linear regression was conducted in R with percentage risk choice as the dependent variable, structure GMV as the independent variable, and total intracranial volume as a covariate. Structures and risk types were examined separately. Left caudate GMV predicted increased rate of risking loss to others ($t = 2.219$, $p = 0.033$). Right putamen GMV predicted decreased rate of risking loss to self ($t = -2.267$, $p = 0.030$). No significant associations were present for other substructures. Results suggest different risks to self and others related to distinct basal ganglia substructures. Previous work suggests distinct roles for the caudate and putamen in risk taking, with the former involved in anticipating/planning goal achievement and the latter involved in implementation and stimulus learning. We did not replicate previous studies finding associations between NAcc GMV and risk taking, but this may be driven by the small sample size. We also cannot rule out involvement of other parts of the brain.

Title: The geospatial literary map of alabama authors of the 19th and 20th centuries

Primary Author: Kevien Shelton

Additional Authors: Corey McDaniels;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Alabama's literary heritage, spanning the 19th and 20th centuries, is a testament to the deep cultural roots of the Southern United States. Heritage that includes a wide, diverse range of authors including civil rights leader Dr. Martin Luther King and even rock musician Jimmy Buffet. The challenge lies in adequately showcasing this history. In the case of such history, words don't capture half as much as a digital representation would. Alabama residents would be able to relate to such history much more if it were to be placed in geographical form. Such a realization sparked the idea of creating a literary map, encompassing all Alabama authors from the 19th and 20th centuries to celebrate and preserve this cultural legacy. Drawing on existing geospatial digital methodologies, the Alabama Authors digital literary map was conceived using advanced mapping tools and spreadsheet data. The project involved collecting and organizing data about the authors, which was then fed into Neatline, a map creation software to display this data geospatially. This data included personal details of the authors, tracked throughout the project's duration. The map was crafted by assigning each of the 153 authors to one of the 67 counties in Alabama, with each author's connection to their respective counties marked using HTML. The mapping of these authors was done in a few steps: Data review, find county, and add author to county by respective connection. This semester-long process resulted in a geospatial representation of the authors' ties to specific locations within Alabama. This provides both a physical and spatial context for their historical significance. Later, this project will be enhanced by AI to enrich the literary data and streamline similar mapping endeavors.

Title: Investigate the exogenous hepato-dopaminergic effect of Bisphenol-A and Bisphenol-S exposure on postpartum male Long-Evans rats

Primary Author: Keyi Liu

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Benson Akingbemi;Preston Cook;Suhrud Pathak;Surekha kadannagari;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Our contemporary studies have revealed the effects of developmental exposures to Bisphenol-A (BPA) and Bisphenol-S (BPS) on hepatocellular function in male Long-Evans rats. Our scientific studies revealed the effect on prooxidants/antioxidants, pro-inflammatory/anti-inflammatory markers, pro-apoptotic/anti-apoptotic markers, and mitochondrial function in the liver. Recent scientific literature signifies that an intense rise in Apoptosis, Oxidative Stress, Inflammation, and Mitochondrial Dysfunction can affect monoaminergic neurotransmission. Therefore, the current study examined the acute postnatal effect of BPA and BPS on monoaminergic neurotransmission. This study investigated the acute developmental effect of BPA and BPS on the synthesizing and degrading enzymes associated with dopaminergic signaling, including Tyrosine Hydroxylase (TH), aromatic L-amino acid decarboxylase (AAD), Catechol-O-methyltransferase (COMT), Monoamine oxidase (MAO) in male Long-Evans rats. The BPA and BPS were administrated by drinking water (5 and 20 micrograms/Liter) to 21-day-old male rats for 14 days. The research shows a significantly decreased activity of TH (*$p < 0.05$) and a significantly increased activity of COMT (*$p < 0.05$). In contrast, BPS exhibited a significant inhibitory effect on MAO activity (*$p < 0.05$). The dopaminergic pathway is implicated in the central neuron system and the liver metabolome via the striatal pathway. Striatal dopamine signaling is involved in the peripheral exogenous chemical metabolism by regulating various Cytochrome P450 (CYP) enzymes. In conclusion, the current study revealed the consequence of postnatal exposure to BPA and BPS on dopaminergic signaling in the liver.

Title: Exploring the effects of gold nanoparticles on mitochondrial function

Primary Author: Kiana Sargent

Additional Authors: Priscila Lotsch;Abner Magalhaes Nunes;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Nanotechnology has been ever evolving, providing significant technological advancements. Engineered nanomaterials (ENMs) are currently being applied in a broad range of markets and industries including in the biomedical field. Due to fascinating physicochemical properties, gold nanoparticles (AuNPs) are the most studied type of ENMs for biomedical application. However, the toxic effects of gold nanoparticles on biological systems is still understudied, particularly in a more realistic human exposure scenario (low doses, long-term effects) within mitochondria. Mitochondrial dysfunction is mostly characterized by perturbations in the oxidative phosphorylation system (OXPHOS), leading to overproduction of a mitochondrial reactive oxygen species (mtROS) and promoting a state of oxidative stress within the cell. Dysfunction of the OXPHOS system is a major cause of human diseases and the impact of gold nanoparticles at low doses on the OXPHOS systems is largely unknown. Hence, the goal is to assess the short and long-term effects of gold nanoparticles with different physicochemical properties on human primary cells on the OXPHOS system. AuNPs with different shapes (spheres and rods) and surface chemistries were synthesized and characterized by UV-Vis, Zeta Potential, DLS, and CytoViva. Human dermal fibroblasts (HDF) were exposed to AuNPs at low doses in short-term (up to 72h). Cytotoxicity test (MTT) and ROS measurements (by dichlorofluorescein assay) were performed in quintuplicates where no cytotoxic or induced increase in ROS levels compared to the control cells (not exposed to AuNPs). AuNPs at low doses (0.1 nM) showed no cytotoxic or induced increase in ROS levels compared to cells in absence of AuNPs. Disruption in the oxidative stress pathway will be also evaluated at the molecular level by qPCR. The short and long-term impact of different types of AuNPs at low doses on OXPHOS will be evaluated by the SeaHorse assay.

Title: Alzheimer’s Disease biomarkers diagnosis in omics using liquid chromatography mass spectrometry coupled with ion Mobility (LC-IM-MS/MS)

Primary Author: Kimberly Kartowikromo

Additional Authors: Ahmed Hamid;Orobola Olajide;Zach Love;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Alzheimer’s disease (AD) is a form of dementia, a neurodegenerative disease that accounts for 50-70% of dementia cases. It is also one of the most common causes of death and represents a major economic burden. In general, AD is caused by the aggregation and build-up of extracellular beta-amyloid plague deposits in the brain, and intraneuronal neurofibrillary tangles with hyperphosphorylated tau protein. Unfortunately, there is no cure for Alzheimer's yet, only treatments that can slow the progression of the disease are available. This presentation describes our studies characterizing the molecular structure of these biomarkers using a proteomic approach utilizing LC-IM-MS/MS methods. Protein standards that were used for the development of the LC-IM-MS/MS method are amyloid beta 1-42 (Aβ1-42) and tau-441. Using the LC-IM-MS/MS method, the intact Aβ1-42 had a retention time of 9 minutes while the mass spectra showed that the 5-charge state ion (m/z 903.26) and the 6-charge state ion (m/z 752.90) were the most abundant precursor ions in the positive ion mode. In addition, amongst several observed fragment ions, b40 (m/z 1078.29) was observed for the 4-charge precursor ion (m/z 1128.83) at a collision energy (CE) of 20 V. Interestingly, 5 partially resolved IM peaks corresponding to 5-charge ion (m/z 903.26) was observed. Meanwhile, tau-441 protein eluted around 7 minutes resulting in MS peaks with charges between 35 and 40 in both modes. The deconvolution tool, UniDec, resulted in 45 kDa indicating tau-441. Digestion of Aβ1-42 and tau-441 was slightly optimized and carried out with trypsin at 60 C for 1.5 hours with shaking. This yielded in the identification of all the composing peptides on Skyline and the peptides eluted between 0-10 minutes. The fragments of the peptides were visible at a CE of 20V. Next, LC-IM-MS/MS will be performed on intact tau-441 to study the IM spectra and fragmentation patterns.

Title: An experimental controlled study investigating emotional and behavioral responses of dietary social control in romantic relationships

Primary Author: Kimberly Marten

Additional Authors: Joshua Novak;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Despite literature showing that romantic partners influence each other's dietary behavior through health-related social control, a dearth of research has utilized an experimental controlled study design to examine associations between social control and the recipient's emotions and behavioral intentions. The present study utilized 444 participants from a Prolific panel who were randomly assigned to four conditions based upon how their partner conveys diet-related messages: hope, worry, anger, and affection. First, a MANCOVA was conducted to examine how these conditions varied across eight emotional responses. Second, we conducted a multiple group structural equation mediation model to examine specific mechanisms. Results revealed that those who were consistently angry were significantly associated with the experience of both greater positive and negative emotions than the other conditions. Finally, individuals that were angry when processing their dietary conditions intended to change their dietary behavior directly and indirectly through greater shame, frustration, and anger, and less affection and gratitude.

Title: Beyond the Screen: Understanding Social Media Use and Addiction of College Students

Primary Author: Kiwan Nam

Additional Authors: Bogeun Seo;

Department/Program: Business Analytics and Info Systems

College: Harbert College of Business

Abstract: Investigating campus-wide college students' effects of social media usage time and interested types of algorithm on their mental health issues and academic performance through focus group interviews. The investigation will employ a qualitative approach, utilizing focus group interviews as a means to gather in-depth insights from students. These interviews will be structured to explore various appearances, including the time spent on different types of content on Instagram. The study will analyze how prolonged exposure to specific content types influences students' mental well-being, focusing on potential correlations between excessive screen time, information overload, and dopamine levels. Moreover, the research aims to clear up the interplay between content preferences and academic performance, aiming to uncover whether certain content choices are associated with better or worse GPA. In particular, we will investigate the following two questions. RQ1. What makes college students active in using Instagram? RQ2. Who are active users of Instagram? To answer the above two questions, we will use Nvivo, a qualitative data analysis software, which will be used to analyze results of FGIs by collecting data of college students who are using Instagram. From this data, we decided to divide 3 different active groups (0-50 minutes, 51-70 minutes, 71+ minutes). Doing so, it creates connection to the Instagram addiction. Overall, by providing a stimulus through an app of such important things, for example, grades, assignments, resume, applying to companies, and etc.. Consequently, the reasons behind social media addiction are likely linked to dopamine, and digital detox (reducing dopamine entropy) is suggested as a means of prevention or resolution.

Title: 3D In Vitro Model to Study Colorectal Cancer in Insulin-Sensitive and Insulin-Resistant Microenvironments

Primary Author: Kwaghtaver Samuel Desongu

Additional Authors: Elizabeth Lipke;Michael Greene;Jannatul Ferdous Nipa;Grace Hester;Ifeoluwa Odeniyi;Peter Abraham;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Despite the decline in mortality rates in the US, colorectal cancer (CRC) remains the third-most common cancer and the second-leading cause of cancer related deaths in the US. CRC has been epidemiologically linked with obesity and insulin resistance (IR) could underlie this link . While there are in vivo and in vitro models developed to understand CRC progression, there is a lack of in vitro models that incorporate IR condition. Here, we developed a 3D engineered CRC cancer in vitro model to mimic the insulin sensitive (IS) and IR CRC tumor microenvironment to study the CRC progression.To achieve this, we encapsulated HT29 CRC cells with in hydrogels using poly(ethylene glycol) fibrinogen (PEG-Fb) biomaterial, and cultured them in IS and IR conditioned media (CM). To obtain the IS CM, we differentiated 3T3 L1 fibroblasts into adipocytes and collected the media. To create the IR CM, we further treated the differentiated matured adipocytes with tumor necrosis factor (TNF) alpha and hypoxic conditions and collected the media 12 hours post-treatment.We cultured engineered CRC tissues in 50% media B and 50%CM for 15 days. Firstly, engineered CRC tissues cultured in IS and IR conditions remained viable and colony sizes grew during the culture duration. In addition, engineered tissues cultured in control media showed smooth, round colonies, whereas IS and IR tissues showed rough, fragmented colonies, with the latter feature observed more in the IR condition. Over culture duration, we observed that more cells migrated out of the hydrogels in the IS and IR conditions compared to the control on days 10, 13, and 15 of culture. In addition, the percentages of proliferating cells in the control, IS, and IR are 8.44%, 29.7%and 21.8%, respectively on day 15.Our results suggest that IS and IR conditions both make the cells more migratory and increase cells proliferation rate. In addition, we hypothesize that IS and IR may be driving EMT. Therefore, we will carry out tissue staining and gene analyses to test our hypothesis.

Title: Artificial intelligence and its pivotal role in epilepsy healthcare

Primary Author: Lacey Marshall

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Epilepsy has been and will continue to be one of the most prominent neurological diseases known to humans. This debilitating neurological disease affects people across different age groups and sexes. This being said, many treatment approaches are being explored to help those dealing with this disease. These may include but are not limited to pharmacological, surgical, and dietetic treatments. These treatments, although effective, have been found to cause a large number of adverse drug reactions and hypersensitivity reactions throughout the epilepsy patient population and can be extremely harmful. While there are many treatments in place, we still cannot eradicate or prevent epilepsy. There is a significant need to find more efficient treatments/therapies and novel approaches for early diagnosis, disease, prevention, and effective pharmacological options. The healthcare goal is to reduce the cost and incidence of disease occurrence as well as prolong the life with reduced morbidities of those who have this neurological disease. With enhanced and quality healthcare in mind, it is important to look further into the current modern technology available that might help to accomplish these healthcare goals. The current study will further elucidate the role of artificial intelligence in epilepsy. The idea is that technological systems can now perform tasks and process data in ways that humans physically cannot bring hope in regard to how the treatment process of epilepsy will be approached. Artificial intelligence is gaining importance worldwide as it is starting to be used to prevent, diagnose, and treat different neurological diseases. Artificial intelligence is the key to neuroscience treatments of the future and will help to control morbidity, mortality, and symptoms of future epileptic generations.

Title: The decibel dynamics of new technology in landscape maintenance

Primary Author: Landon Erbrick

Additional Authors: Mark Hoffman;Beau Brodbeck;Kati Kent;Paul Bartley;

Department/Program: Horticulture

College: College of Agriculture

Abstract: The movement towards the electrification of the landscape industry is becoming more prevalent due to the legislative restrictions and advancements in battery technology. However, with the impending restrictions there is very little research in this area to aid landscapers in integration. One of the major factors for restricting the use of gas-powered landscape equipment is the noise they create, especially gas leaf blowers. Understanding the decibel outputs of both gas and battery-powered equipment and their effects on users and passerby's is lacking. According to manufacturers of gas-powered equipment, decibel levels exceed 95 dBA at the operator's ear and 65-80 dBA at fifty feet. Noise above 85 dBA for a prolonged period of time leads to health risks for the user. The most common health risk is hearing loss, from which 40 million Americans 18 years and older suffer. In the U.S., millions of these devices are used yet little research has been performed in this industry. This study was performed to understand the decibel levels of both types of equipment at eight different points around the operator at distances of three and fifty feet. This spatial data offers information on where the equipment has the highest decibel output as well as an output average. With this data we were able to calculate the percent differences between the gas and battery-powered equipment to understand their differences. Future research will be conducted to understand decibel dosages for landscape maintenance operators who use the equipment for prolonged periods.

Title: Barriers to seeking mental health treatment for Auburn students

Primary Author: Landon Grooms

Additional Authors: Sara Driskell;Angel Perry-Jackson;Isabella Lord;Jiya Lewis;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Mental health is embedded in our everyday lives, and negatives concerns with mental health are far more common than people realize. However, the unfortunate reality is that many barriers prevent people from receiving adequate mental health care. Common barriers include access and limited availability of mental health practitioners and services, cost of service, insufficient mental health care policies, mental health illiteracy, and stigma. This pilot research aims to learn how barriers influence those Auburn students and to better understand their attitudes toward mental health care. We surveyed 819 students about their beliefs about seeking mental health treatment, barriers to that treatment, and what format they prefer for treatment. Overall, students reported many discrepancies in how they view mental health treatment. They say that most people have issues that could be addressed with therapy and half of people do go to therapy. However, they say their family and friends have rarely received psychological services and that they have not heard of on-campus psychological services. On a positive note, they agreed that there shouldn't be any stigma for going to therapy and that making time for one's mental health is important. Overall, these students reported that barriers related to finances and time were most important to them, but they also felt their social support systems were limited. Students strongly preferred in-person therapy to online and especially text-based options, but they did not the convenience of online therapy and indicated some interest in online therapy if it were covered by their insurance. This research will help us begin addressing these barriers and ensuring more mental health care for students.

Title: In-Game Pelvis and Lower Extremity Kinematic Differences Between Pitch Types in Collegiate Baseball Pitchers

Primary Author: Laura Daffin

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

Department/Program: School of Kinesiology

College: College of Education

Abstract: Baseball pitchers often throw multiple pitch types during games. Previous laboratory studies have found biomechanical differences between pitch types, but little research exists on in-game differences. This study aims to determine if there are pelvis and lower extremity (LE) kinematic differences between pitch types during competitive games. Thirty-four NCAA Division I collegiate baseball pitchers (1.9[0.1]m; 94.5[10.5]kg) that threw three in-game fastballs (FB), breaking balls (BB), and changeups (CH) were included. Pelvis and LE kinematics were recorded using a markerless motion capture system (300Hz) during competitive games. Kinematics of each pitcher's first three pitches of each pitch type were averaged for analysis. A repeated measures multivariate analysis of variance (MANOVA) was used to assess differences between pitch types (alpha=.05). The MANOVA revealed a significant effect of pitch type ($F(18, 116)=5.102$, $p<.001$). Follow-up univariate analyses showed a significant main effect ($p<.05$) of pitch type for lead knee angular velocity, lead knee angular velocity before ball release (BR), lead footstep width, lead knee extension at BR, center of mass velocity, and pelvis rotational velocity. Pairwise comparisons found lead knee angular velocity was greater in FB than CH (mean[SD] within-subjects difference: 44[68]deg/s). Lead knee angular velocity before BR was greater in FB than CH(86[56]deg/s) and BB(50[78]deg/s) and greater in BB than CH(36[62]deg/s). Step width was greater in BB than FB(1[2]in) and CH(1[2]in). At BR, lead knee extension was greater in FB than CH(8[7]deg) and BB(4[9]deg). The center of mass velocity was greater in FB than in CH(2[4]in/s). Pelvis rotational velocity was greater in FB than CH(18[38]deg/s) and BB(25[38]deg/s). This study showed that collegiate pitchers use different in-game pelvis and LE kinematics between pitch types, which may be mechanisms that help pitchers successfully throw different pitch types.

Title: Advancing the Early Stages of Brown Rot Fungi Detection: NIR Spectroscopy Integrated with Chemometrics

Primary Author: Laura Michelle Nieto Arciniegas

Additional Authors: Brian Via;Iris Vega Erramuspe;Lori Eckhardt;Tom Gallagher;Brea Thomas;Astrid Rojas Marquez;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Near-infrared spectroscopy (NIRS) offers a rapid, non-destructive approach to early detection of wood rot decay. This study utilizes NIRS, integrated with chemometric modeling, to assess early wood degradation caused by brown rot fungi (BRF). We subjected Loblolly pine (Pinus taeda) samples to controlled decay by four different BRF: Gloeophyllum trabeum, Wolfiporia cocos, Fibroporia radiculosa, and Postia placenta. Periodically, we analyzed the elemental composition, lignin, and carbohydrate content of three different replicates. This data was then correlated with NIRS spectra using multivariate analysis. Our findings demonstrate the effectiveness of using chemometric models in interpreting these correlations. Moreover, the results hold significant potential for rapidly assessing the integrity of fallen timber in situ. This capability could enable landowners to optimize the timing for timber sales, preventing loss due to decay and maintaining material integrity.

Title: Exercise protects from fiber type shift in obese muscles by enhancing mitochondrial biogenesis and dynamics

Primary Author: Lauren Jun

Additional Authors: Ramesh Jeganathan;Geetha Thangiah;Hassan Ali H Jafari;Emily Knight;

Department/Program: Nutrition and Food Science

College: College of Human Sciences

Abstract: Skeletal muscle is composed of bundles of muscle fibers known as myofibers. In mammalian skeletal muscles, three major types of muscle fibers exist: slow-twitch oxidative fibers (Type I), fast-twitch oxidative fibers (Type IIA), and fast-twitch glycolytic fibers (Type IIB/X). Each fiber type possesses a distinctive composition of contractile proteins influenced by contractile and metabolic properties. The oxidative muscle fiber types contain higher mitochondrial content, relying primarily on oxidative phosphorylation for ATP generation. Notably, in obesity, or when subjected to prolonged exposure to a high-fat diet, skeletal muscle undergoes a shift in fiber type towards glycolytic type. Mitochondria is a highly dynamic organelle, constantly undergoing mitochondrial biogenesis and dynamics processes. Previous studies have shown that obesity impacts mitochondrial metabolism, primarily through the alterations of mitochondrial biogenesis and dynamics machinery induced by intramuscular lipid accumulation. Thus, our study aims to explore the impact of obesity on skeletal muscle mitochondrial biogenesis and dynamics and whether the skeletal muscle fiber type shift occurs from the aberrant mitochondrial machinery. Furthermore, we investigated the potential of moderate-intensity exercise in mitigating the obese-induced skeletal muscle fiber type shift.

Title: Extent of use of supplemental feeding in beef cattle operations across the Southeast: A regional survey

Primary Author: Lauren St. Andrew

Additional Authors: Brandon Smith;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: With input costs on the rise, researchers and producers, alike, are seeking alternative management strategies for profitable and sustainable beef production. Studies suggest that supplemental feed provided to grazing cattle may be used to offset some of the cost. However, there is a lack of knowledge on the extent of supplemental feeding programs in the southeastern US and which feeds may be used in these programs. Thus, the objective of this study was to better understand supplemental feeding practices and choices among beef producers in the southeastern US. To address this objective, a 24-question survey was distributed through Extension and commodity organizations to beef producers across the Southeast. This survey received 116 complete responses. The majority of respondents operated cow-calf production systems (65.6%) on either tall fescue or bermudagrass pastures (32.7 and 28.0%, respectively). Approximately 88% of these producers employed some type of supplemental feeding strategies. The leading commodity used was corn (61.4%), while common byproducts included whole cottonseed, corn gluten feed, and soybean hulls (17.1, 16.6, and 14.4%, respectively). At the end of the survey, participants were asked to submit a sample of their byproduct supplements for nutritive value analysis to form a regional dataset. Some of the products obtained included whole cottonseed, cotton byproduct, corn gluten meal, distillers' grains, chicken litter, and others. The crude protein of the samples ranged from 13.3% to 30.3% (mean = 20.3%). Sample NDF ranged from 46.0% to 76.3% (mean = 60.5%). With this information, results will be used to formulate feed choices in upcoming research projects directed at supplemental feeding to reduce fertilizer inputs as part of the pasture ecosystem.

Title: Nine-banded armadillo (Dasypus novemcinctus) burrow use by commensal species

Primary Author: Lauren Stevens

Additional Authors: Olivia Sciandra;Wesley Anderson;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: In ecology numerous commensal relationships have been documented. Of these, some of the most important species that provide commensal refugia are terrestrial burrowing species. One particularly important species is the gopher tortoise. Over 350 commensal species have been recorded using their burrows. Unfortunately, the gopher tortoise has declined over much of its range. However, another burrowing species, the 9-banded armadillo (Dasypus novemcinctus), has been expanding its range throughout the southeastern United States and could be providing alternate subterranean habitat for commensals. To better understand commensal use of armadillo burrows, we initiated a study on private properties in Mobile, Alabama between May and August 2023. We surveyed 76 burrows – 47 at rural sites and 29 at urban sites – using a burrow scope. Rural burrow dimensions averaged 19.3cm /- 0.7cm (SE) in height, 24.5cm /- 0.9cm in width, and 141.2cm /- 9.0cm in length. Urban burrow dimensions averaged 17.5cm /- 0.6 in height, 24.3cm /- 1.0 in width, and 127.2cm /- 12.0cm in length. A two-sample t-test between the rural and urban sites revealed significantly higher burrow at rural sites, but no significant difference in width and length. Twenty-seven of 47 rural burrows (57.5%) surveyed had at least one commensal species with a range of 1-4 whereas 16 of 29 urban burrows (55.2%) had at least one with a range of 1-2. We observed the following commensal taxa – cave crickets, cockroaches, field crickets, flat-back millipede, two taxa of spiders, crane flies, harvestmen, Virginia opossum, and two species of anurans – within surveyed burrows. Commensal species richness does not appear to approach the levels observed in gopher tortoise burrows. Although not likely as valuable from a conservation perspective as gopher tortoise burrows, armadillo burrows are utilized by commensal species in southwest Alabama.

Title: Addressing the Mental Health of International Students in US Higher Education: Strategies and Challenges

Primary Author: Leticia Raymundi Pinheiro

Additional Authors: Pamela Short;

Department/Program: Nursing

College: College of Nursing

Abstract: The topic of mental health among international students attending college in the United States has been gaining more recognition in recent years. As the percentage of students coming to the U.S. to pursue higher education increases, awareness regarding the challenges associated with this population has been highlighted. This literature review examines discrepancies in the mental health of international students as they navigate personal and academic obstacles related to cultural and social adaptation, language barriers, and finite access to resources that further lead to role impairment. By addressing disparity in care and means among foreign students, we can better acknowledge and provide evidence-based interventions and strategies to manage mental health struggles, focusing on creating a more inclusive and supportive environment for the academic success and overall well-being of these students. This project encourages further research and collaboration efforts to develop and implement effective strategies such as increased cultural competency training for faculty and staff, establishing peer support groups, and promoting outreach efforts to bridge the gap between international students and the challenges they encounter.

Title: Stochastic obstacle scene problem with limited dynamic learning capability

Primary Author: Li Zhou

Additional Authors: Elvan Ceyhan;

Department/Program: Department of Mathematics and Statistics

College: College of Sciences and Mathematics

Abstract: We consider the Stochastic Obstacle Scene a problem, where a navigating agent (NAVA) traverses through an uncertain region containing disk-shaped potential obstacles. NAVA possesses limited dynamic learning capability, allowing NAVA to disambiguate an obstacle's actual status at its boundary with an additional cost. The goal is to design a traversal policy that utilizes dynamic learning capabilities to minimize the expected total traversal cost. We cast the problem as a Weight Constrained Shortest Path Problem (WCSPP) and introduce a Bayesian approach to assess the risk of each path encountering true obstacles. Guided by the risk measurement and the number of intersected ambiguous obstacles, the WCSPP policy determines the traversal path by solving a constrained optimization problem. We propose an efficient Lagrangian relaxation-based algorithm with multiple graph reduction steps to find the solution. Through both theoretical and empirical results, we demonstrate that the proposed algorithm significantly reduces the graph size compared to existing methods and generates optimal solutions without a duality gap in our setting. Using Monte Carlo simulations, we test various baseline policies from the literature alongside the proposed WCSPP policy. The results provide evidence that the new policy exhibits better theoretical properties and consistently outperforms existing ones, achieving a lower expected total traversal cost.

Title: Characterizing the recombination landscape of the Mississippi diamond-backed terrapin (Malaclemys terrapin pileata)

Primary Author: Logan Havard

Additional Authors: Matt Wolak;Laurie Stevison;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Meiotic recombination continually erodes associations between alleles when crossing over occurs between homologous chromosomes. This shuffling of alleles can impose significant evolutionary and genetic consequences on haplotypes, including how populations respond to evolutionary forces, and plays a fundamental role in ensuring proper chromosomal segregation during meiosis. Despite recombination's prevalence in sexually reproducing organisms, meiotic recombination rates vary by taxa, population, and even within individuals. As a result, detailing recombination rate landscapes at fine-scale genome-wide levels can provide important historical and demographic insights about populations, which is particularly valuable in studying species of conservation and ecological interest. Unfortunately, our understanding of recombination rate variation is limited in reptiles as recombination patterns have been characterized very well in only some parts of the tree of life. Here, we focus on characterizing the recombination rate landscape of the diamond-backed terrapin (Malaclemys terrapin). Its impressive latitudinal range spanning the Atlantic and Gulf of Mexico coasts and evidence of local adaptation make it a valuable system for studying the extent to which associations between alleles are maintained in differing local environments. Further, terrapins have temperature-dependent sex-determination and sexual size dimorphism, both or either of which could shape their recombination rate landscape in unique ways. We will develop a fine-scale recombination map that spans all 25 chromosomal intervals using whole-genome sequence data collected from 19 Mississippi diamond-backed terrapins (M. terrapin pileata) with 20-40x coverage. From this map, we will infer features of terrapin demography, evolutionary history, and recombination rate landscape. This, in turn, will broaden our knowledge of how meiotic recombination landscapes differ within genomes in this part of the tree of life.

Title: The impact of temperature on the behavior and characteristics of Polyurethane synthesized from Pine Bio-oil.

Primary Author: Lucila Carias

Additional Authors: Brian Via;Lorena Alexandra Portilla Villarreal;Sushil Adhikari;Manish Sakhakarmy;Iris Vega Erramuspe;Jordon Hoyer; Maria L. Auad

Department/Program: Polymer and Fiber Engineering

College: Samuel Ginn College of Engineering

Abstract: This study explores the effects of temperature variations on the kinetics and properties of polyurethane (PUR) synthesized from pine bio-oil. Polyurethane is a versatile polymer widely used in various industrial applications due to its desirable properties. Pine bio-oil is a renewable resource and offers an environmentally friendly alternative for the OH group provider for polyurethane production. By analyzing the kinetics and properties of polyurethane at different temperature conditions, this research aims to elucidate the relationship between temperature and the behavior of the synthesized polymer. Experimental results using the NTH-order kinetic model indicate significant temperature-dependent variations in PUR formation and its resulting properties. Understanding these temperature influences is crucial for optimizing the production process and tailoring PUR properties for specific applications, thereby advancing the utilization of pine bio-oil as a sustainable feedstock in polymer synthesis.

Title: Convergence science: merging meat science and lean six sigma approach to improve further processing efficiency using burger manufacturing as a model process.

Primary Author: Luis Jose Guzman Sabillon

Additional Authors: Amit Morey;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Production efficiency of a further processing plant is highly dependent on meat quality, equipment, and operation procedures. A unique study converged the Lean Six Sigma approach and Meat Science to improve efficiency of a further processing plant (burger manufacturing as a model) by reducing waste and yield loss. The research measured the current processes, conducting a systematic in-plant study, and discussing the outcomes with the operations team to ensure process improvement. Four key production stages were identified for data collection: 1. the receiving room scales: calibration, cleanliness standards, and operational training; 2. combo dumping: purge and leak from the hopper; 3. water misting: nozzles efficiency and water addition and coverage; 4. empty box weights: measurements taken on boxes from different lots. The research used Lean tools such as Define, Measure, Analyze, Improve, and Control (DMAIC), Kaizen, Poka-Yoke, 5S, Statistical Process Controls (SPC), and linear regression models using Minitab. The receiving scales showed a considerable variance (n=345), with 79 percent of meat combos weighing heavier than vendor-provided weights. 5S methodology was used for sorting, setting in order, shining, standardizing, and sustaining the area, in addition to Poka-Yoke for visual management of instructions. The combo dumping process (n=145) showed a direct correlation (0.42) between the lean percentage and the purge volume. Kaizen methodology combined with a pull system was recommended to improve process design. The water misting process (n=372) showed that 38 percent of patties lost weight at post-freezing. DMAIC engaged with SPC, linear regression models were used to measure the process, and the Kaizen methodology was recommended for continuous improvement. Finally, the standardized tare weight for the boxes (n=1200) used SPC to determine an individual box weight of 0.92 lb. This convergent approach will improve production efficiencies of further processing operations.

Title: Decoding diffusion in dietary fiber networks

Primary Author: Luke May

Additional Authors: Symone Alexander;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Title: Decoding Diffusion in Dietary Fiber NetworksPrimary Author: May, Luke T.Additional Authors: Alexander, SymoneDepartment/Program: Chemical EngineeringCollege/School: Samuel Ginn College of EngineeringAbstract: In the biomedical community, there is concern for the increasing mortality rates in chronic kidney disease. Due to the lack of developmental research, treatment revolves around dialysis and transplantation. Dialysis is unpopular among patients because of the immense physical and mental symptoms, and the waiting list of those needing transplants outpaces that of performed transplantations. However, high-fiber, plant-based diets have shown a positive impact on clearing the uremic toxins that result from chronic kidney disease. Yet, there is a distinct lack of understanding of why this occurs due to the absence of accurate three-dimensional (3-D) diffusion models of nondigestible fiber. Targeting this discrepancy, an observational model was designed in AutoCAD, 3-D printed, and then cast with polydimethylsiloxane (PDMS) to facilitate an all-in-one approach to sample preparation and experimentation. Inspired by the flexibility of an ice tray, the novel PDMS-based process reduced necessary glassware and waste by over 50%%20and drastically simplified the observational process. Samples in the model were incubated, freeze-dried, dye-stained, and analyzed using 3-D nondestructive nano-computed tomography (Nano-CT) and ImageJ’s FIJI to investigate the structure-property link between nondigestible fiber and its adsorptive properties. Through the diffusion-based characterization of these natural biopolymers, the resulting images reveal new insight into dietary-based symptom alleviation of chronic kidney disease.

Title: Effect of silo type on fermentation characteristics of laboratory-scale silage

Primary Author: Macy Rockwell

Additional Authors: Kim Mullenix;Leanne Dillard;Aeriel Belk;Cecilia Nicole Sagastume Fernandez;Aghata Moreira da Silva;Lauren St. Andrew;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Baleage, or baled and ensiled forage, is a useful technique for deferred feeding of forage in times of limited grazing availability. While research efforts are underway across the Southeast on management strategies for baleage production, field-scale baleage production is often resource-prohibitive. However, there is a void in the literature on the suitability of small- or laboratory-scale techniques for producing ensiled forage. Thus, our experiment sought to determine if laboratory-scale ensiling techniques could provide research results similar to field conditions. Alfalfa-bermudagrass forage was harvested and subjected to one of 12 ensiling techniques: field-scale baleage (CON), miniature baleage (MINI), large or small fermentation bucket (6GAL or 2GAL, respectively), miniature silo (PVC), pint-sized Mason-type jar with "BurpLid" (BURP), fermentation lid (BALL), or airlock lid (LOCK), single-layered vacuum-sealed bag using a chamber-style (CHMB) or suction-type sealer (FOOD), or double-layered vacuum-sealed bag using the same sealers (CHMB2 or FOOD2, respectively). After allocation to treatment, samples were fermented for 56 d. Following fermentation, samples were assayed for NDF, ADF, ADL, CP, pH, mold, and VFA. Dunnett's test revealed a difference ($P < 0.05$) from CON for NDF, ADF, and pH. Samples from PVC had 26% greater NDF and 45% greater ADF than CON (58 and 37%, respectively). Samples from BALL were 3 units greater and samples from LOCK were 2 units greater in pH than CON (4.8). When comparing among laboratory-scale treatments, there were differences ($P \leq 0.01$) in NDF, ADF, ADL, pH, and mold counts. Butyrate from MINI and 2GAL were greatest, and lowest from FOOD2 and CHMB2. Results are interpreted to mean that BALL and LOCK are not effective representatives of field-scale silage production due to lack of pH drop, while PVC alters the fiber profiles. All other methods showed promise as prospects for laboratory silage procedures.

Title: Assessment of wing damage at different points of occurrence during poultry processing

Primary Author: Madalyn Jennings

Additional Authors: Fanny Abigail Contreras Zelaya;Montana Riggs;Abigail McConnell;Dianna Bourassa;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Wing damage is a common occurrence in processing facilities that can negatively affect both the company's efficiency and profitability. Multiple areas during production and within a processing plant can result in wing damage including live production, harvest, tipping, shackling, stunning, bleeding, and picking. Our objective was to evaluate the appearance of wing damage at various points of occurrence within a commercial processing plant. Broilers were evaluated at live haul for birds with visually damaged wings. For any bird with a damaged wing, the wings were photographed, and the bird was banded and then placed in the same crates as birds with undamaged wings. Then birds were sent through processing and carcasses were removed from the line at two different points, post-bleeding, and post-picking. For the first trial, there was a total of 600 birds, with 50 birds tagged at live haul as having various levels of wing damage. Birds were then stunned and bled and evaluated immediately post-bleed. Wings were defined as damaged or not damaged at each time point. Damaged wings were then subcategorized as having bruising, torn skin, bone dislocation, or broken bones. Following picking, damage was further categorized as clean (no blood present) or with blood. Statistical analysis was conducted using the Chi-Square for non-parametric data with a significance level at $P \leq 0.05$. Wing damage increased from 7%%20 at live haul to 22%%20post-bleed and further increased to 36%%20post-pick ($P \leq 0.0001$). Within the damaged wings, bruising was higher post-bleed (21%) and post-pick (15%) than at live haul (7%, $P \leq 0.0001$). After picking, dislocations (7%), broken bones (3%), and torn skin (10%) were higher than dislocations, broken bones, and torn skin at live haul (0.1%, 0%, and 0.1%, respectively) and post-bleed (0.8%, 0%, and 0%, respectively, $P \leq 0.0001$). Of all damaged wings post-pick 17%%20 were clean indicating that all damage occurred following blood loss.

Title: Coral captive breeding and restoration method success

Primary Author: Madeleine Park

Additional Authors: Kelly Dunning;Janna Willoughby;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Coral reefs are some of planet Earth's most biologically diverse and important ecosystems. They provide for thousands upon thousands of marine inhabitants; without them, these ecosystems collapse. Coral reefs face many threats including pollution, human development, and most destructive, climate change. However, scientists have developed a multifaceted approach to combating climate change via coral restoration efforts. In this study, we investigated the various relationships between differing coral captive breeding restoration techniques and their success in terms of survival once planted into wild habitats. We first extracted data from 50 scientific publications focused on coral reef restoration in the Florida Keys National Marine Sanctuary and Great Barrier Reef. Then, we characterized relationships between both on-shore and off-shore nurseries, the use of assisted evolution, heat tolerance adaptations, hybridization efforts, out-planting corals, use of cryopreserved sperm, and asexual breeding versus sexual breeding, with the goal of understanding determinants of success in coral restoration projects. We found that the average number of colonies collected and used in captive breeding was 816, while the average number of replicated fragments was 1,777. Overall, studies that used more colonies and had more fragments tended to have different techniques of out-planting and varied in environmental traits. We also found that the number of reef samples collected averaged ~3 reefs, while the average depth averaged 5.0m. Overall and across most captive breeding descriptions, corals adapted to increasing temperatures. In addition, both on-shore and off-shore nurseries as well as out-plantined coral growth displayed positive results, but coral survival was dependent on specific nursery environmental qualities. Coral restoration through captive breeding adaptation to current and future climate conditions is a progressing field with extraordinary conservation potential for marine ecosystems.

Title: Distress tolerance, anxiety sensitivity, and the use of cannabis as a coping mechanism

Primary Author: Madeleine Rein

Additional Authors: Richard Macatee;Mallory Cannon;Julia Gorday;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Rates of cannabis use and Cannabis Use Disorder (CUD) have continued to grow in the United States as legalization of cannabis has increased. CUD has been linked to poor quality of life and worse health outcomes, making it important to identify who may be at risk for developing CUD. One factor of CUD is distress tolerance (DT), or one's ability to tolerate negative affective states. Those with low DT have increased rates of cannabis use, cravings, use related problems, and dependence, which are associated with CUD. This increase in cannabis use by those who have low DT may be a way to regulate negative internal experiences (e.g., anxiety). Repeated use of cannabis as a coping strategy may make someone more likely to meet criteria for CUD. The current study aims to explore the relationship between DT, cannabis-use related problems, coping motives, and anxiety symptom severity. We hypothesize that the strength of the positive relationship between distress intolerance (DI; assessed using the Distress Intolerance Index [DII]) and more cannabis-use related problems (assessed using the Marijuana Problems Scale [MPS]) would increase as coping-related motives increased (Marijuana Motives Measure [MMM]). This hypothesis will be tested with a linear regression between DT and cannabis-use related problems with coping motives as a moderator. Secondly, we hypothesize that DI (DII) will moderate the relationship between anxiety symptoms (Mood and Anxiety Symptom Questionnaire [MASQ]) and use of cannabis for coping (MMM), such that the strength of the positive relationship between anxiety symptoms and coping-related cannabis use would increase as DI increased. This will be tested using a linear regression between anxiety symptoms and coping motives with DT as a moderator. Understanding how DT relates to anxiety symptom severity, cannabis-use related problems, and maladaptive coping is essential to informing treatment for those with CUD.

Title: Genetically modifying the marine bacterium Vibrio diazotrophicus to assess the role of secretion systems in pathogenicity

Primary Author: Madeline Hamborg

Additional Authors: Katherine Buckley;Jake Tatum;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Vibrio diazotrophicus is a gram-negative, facultatively anaerobic bacteria that is present in sea water and has been isolated from the gastrointestinal tract of the adult purple sea urchin (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, which enables single-cell resolution of the system-wide immune response. Like most echinoderms, the S. purpuratus life cycle is biphasic. Bilaterally symmetric larvae are planktonic filter feeders of microscopic algae. In contrast, benthic adults exhibit pentaradial symmetry with a calcium carbonate skeleton and feed on macroscopic algae. Our previous analyses have demonstrated that both forms are susceptible to infection by V. diazotrophicus. The S. purpuratus immune system relies on complex arrays of pattern recognition receptors such as Toll-like receptors and Nod-Like receptors that detect microbes and activate inflammatory responses. In larvae, this response is characterized by immune cell migration and the rapid activation of the cytokine IL-17. We hypothesize that the pathogenicity of V. diazotrophicus in sea urchin larvae is, in part, due to a Type VI secretion system (T6SS). T6SS are transmembrane “syringes” that “inject” effector molecules (such as toxins) into host cells. The Hcp2 subunit forms the shaft of the molecular needle; deletion of this protein should eliminate T6SS function. To characterize the importance of this complex in larval pathogencity, we have developed a suite of novel genetic tools to eliminate the Hcp2 gene from the V. diazotrophicus genome. 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.

Title: Diffusion MRI tractography shows development and maturation of neural pathways in mouse brains.

Primary Author: Madison Bryant

Additional Authors: Christine Charvet;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Diffusion MR tractography is an innovative tool for studying neural pathways in disease and development. In an effort to improve upon current methods of quantifying pathways in the brain in the context of neural development, we explored the potential of TrackVis software to track the development and maturation of pathways in mice. TrackVis was designed to aid in the visualization and analysis of MRI data, and its primary function is to characterize water diffusion in the brain's white matter tracts. To investigate the software's ability to aid neural development research, we scanned nine post-mortem mouse brains with a 9.4T MR scanner. These mice varied in postnatal ages (3, 21, and 60 days after birth). We evaluated the maturation of several pathways, including the corpus callosum, cingulate bundle, as well as fibers emerging from olfactory centers. The capabilities of the TrackVis software provided us with information to discern pathways of mouse brains. We classified pathways in various regions of the brain at different postnatal ages, and we found protracted maturation of fibers coursing olfactory centers. Therefore, diffusion MRI scans can be used to track the development and maturation of neural pathways. Being able to quantify these changes across ages provides insight into the development of the mouse brain and will be valuable for the detection of developmental differences in pathway maturation between species in the future.

Title: Justice system contacts, individual differences, and quality of life

Primary Author: Madison Mcdaniel

Additional Authors: Samantha Fede;

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Wilper and colleagues find that roughly 40 percent of inmates suffer from persistent medical issues while nearly half of prisoners and 60 percent of jail inmates have mental health concerns during incarceration. Past research has shown that incarceration leads to poor outcomes like increased mental health concerns and substance use, higher mortality rates, less community engagement, and less socioeconomic. Although general effects of incarceration have been demonstrated across the lifespan, less is known about the specific effect of prison conditions on these outcomes. Past research fails to consider how individual differences among recently released people might modify potential associations between prison conditions and post release outcomes. Pre-existing conditions and individual differences not only influence the likelihood of incarceration, but also the experience of incarceration. Thus, it is likely that individual differences are an important moderator of how prison conditions might impact post-release functioning. The purpose of this study is to examine the association between justice system experiences and subsequent quality of life. We hypothesize that individuals with more negative justice system experiences will have worse quality of life. The study is an online self-report study focusing on individuals living in the United States with prior justice system contacts, including past incarceration. Participants will be recruited through MTurk and asked to retrospectively report the nature of their interactions with the justice system and rates of exposure to specific negative or positive factors sometimes experienced during justice system involvement. We will assess for both the current timepoint and retrospectively as a pre-justice involvement variable. We anticipate the results of this project will have important implications for justice policy by providing scientific evidence of the need to improve justice system conditions. Future work should investigate this question using a longitudinal design better able to capture changes over time.

Title: Evaluating the experiences of Black graduate students at predominantly white institutions

Primary Author: Makeda Nurradin

Additional Authors: Clarissa Beavers;

Department/Program: Department of Curriculum and Teaching

College: College of Education

Abstract: This research seeks to understand the challenges faced by Black graduate students attending Predominately White Institutions (PWIs) and how they navigate adversity in their academic and social lives. Semi-structured interviews were conducted with graduate students that self-identified as Black or African American. There were five guiding questions being: 1) What are some strategies you used to navigate difficult environments? 2) Which strategies did you find successful? 3) What challenges did you face? 4) Are you aware of similar challenges faced by other Black students? 5) How do you think successful methods can be implemented? Interviews were transcribed, and independent thematic analysis was performed. From the thematic analysis there were themes of similar challenges and successes. The qualitative study highlights how microaggressions, prejudice, and a lack of belonging can create barriers in the pursuit of academic success. Despite challenges, black students use various strategies such as seeking out mentorship and building, community to navigate and succeed. The findings of this research can be used to guide initiatives that better support the academic and professional growth of Black graduate students at PWIs. Some recommendations from this study are fostering environments that value inclusivity-consider increasing diversity in tenure track faculty positions; implement programs that bolster support for professional development; and safe spaces on campus. Ultimately, this study sheds light on the importance of amplifying the voices of black graduate students in academia and creating inclusive environments on campuses. Further research into how black graduate students fare is paramount.

Title: Investigating the relationship between surface water pollution and onsite wastewater treatment systems

Primary Author: Mallory Jordan

Additional Authors: Eleanore Larson;Ann Ojeda;Stephanie Rogers;

Department/Program: Geology and Geography

College: College of Sciences and Mathematics

Abstract: Onsite wastewater treatment systems (OWTSs) are an important, and often underestimated, nonpoint source of pollution to account for in watershed management. However, the limited availability of OWTS data makes it challenging to account for them as a source of water pollution. For this project, we acquired OWTS permits, which provided locations and age estimates of OWTSs, and integrated them with environmental data to model the pollution potential from OWTSs at the watershed scale using GIS-based multicriteria decision analysis. Additionally, in situ water quality parameters – Escherichia coli (E. coli), total nitrogen, total phosphorus, temperature, and pH – were measured along the main tributary at base-flow conditions. Three general linear models were developed to relate E. coli to water quality parameters and OWTS pollution indicators. We found that the model with the OWTS pollution potential had the lowest corrected Akaike information criterion (AICc) value (35.01) and thus the best predictive power of E. coli, compared to the models that included classified OWTS pollution potential input criteria (AICc = 36.76) and land cover (AICc = 36.74). This demonstrates that OWTSs may be a contributor to surface water pollution at base-flow conditions and underscores the importance of improving access to OWTS data (i.e., location and age) to account for these systems in water quality management.

Title: Application of pyrolysis to upcycle pine and sodium silicate composites

Primary Author: Manish Sakhakarmy

Additional Authors: Sushil Adhikari;Sagar Kafle;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: In 3D printing, sodium silicate (SS) can be used as an inorganic binder for wood-based composites due to its better rheological properties, high strength, and affordability. Investigating the recyclability of 3D printed composites is necessary to understand the reusability of the demolished additively manufactured construction waste. In this work, the bio-oil through pyrolysis was produced using pine and SS composites and further characterized to observe the effects of the pyrolysis temperatures and the proportion of SS in composites. Pine and SS composites with 0.00, 33.33, 50.00, and 66.67% of the SS on a mass basis were prepared and cured to mimic the 3D printed composites. Then, pyrolysis of cured composites was performed in a bench-scale fixed bed pyrolysis reactor. From the pyrolysis of composites with 50.00% of SS at 550 °C, a condensed liquid yield of 43.00% (wt. %, dry basis) was obtained. Furthermore, it was observed that on increasing the proportion of SS in the composite, the selectivity towards hydrocarbons and alkyl phenols increased, and methoxyphenols decreased, which enhanced biofuel production. A maximum hydroxyl concentration of 6.54 mmol/g was observed for the bio-oil from pyrolysis of SS-based composite at 600 °C. This study shows the feasibility of upcycling the 3D-printed wood composites through pyrolysis to generate bio-oil that can be used for bio-based resin synthesis and bio-fuel applications.

Title: Thermochemical Conversion of Lignocellulosic Biomass and Valorisation of Bio-Oil Organic Phase to Fuel Range Hydrocarbons

Primary Author: Manqoba Shezi

Additional Authors: Sushil Adhikari;Manish Sakhakarmy;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Lignocellulosic biomass is a potential feedstock for bioenergy production. Bamboo (Phyllostachys Nigra, 'Henon') and pine are among the feedstocks of interest for the production of biofuel via thermochemical conversions. In the present work, the thermochemical conversion of Bamboo and Pine biomass was done to produce bio-oil, biochar, and gaseous products. The continuous pyrolysis was carried out in a sand-fluidized bed reactor at 550 0C for 2 hours with a biomass feed rate of 27 g/min. The product characterization has been carried out to assess the required upgrading technique of the bio-oil organic phase (BOP), i.e. B-BOP and P-BOP for Bamboo and Pine respectively. The maximum yields of bio-oil (organic phase) for bamboo and pine were 9.5 +/- 0.31 and 14.12 +/- 3.37 wt% at total bio-oil yields of 38.95 +/- 0,71 and 48.83 +/- 4.01 wt%, respectively. The biochar yields were 21.90 +/- 1.33 and 16.41 +/- 0.96 wt% while biogas yields were 43.52 +/- 2.05 and 42.58 +/- 4.97 wt% for bamboo and pine, respectively. Bamboo was observed to yield higher biochar and biogas in contrast to the pine biomass, which was seen to yield higher bio-oil. The reacted biomass for the yields above was 2.19 and 3.10 kg for Bamboo and Pine respectively. From biomass proximate analysis the ash content was 1.970 +/- 0,02 and 0.330 +/- 0.07 wt% for bamboo and pine respectively. The composition of the BOP was analyzed using FTIR, and GC-MS techniques. The phenolics were dominant in the BOP, however, B-BOP had more phenolics than P-BOP by % area. The density, k.viscosity, TAN, and ultimate analysis of B-BOP and P-BOP were also analyzed to evaluate properties in a raw state. The B-BOP was observed to have low values of chemical properties, with a total acid number (TAN) of 54.13 +/- 1.24 versus 63.85 +/- 2.45 mgKOH/g for P-BOP. The ultimate analysis showed that P-BOP has higher sulfur content and O/C ratio than B-BOP, while the H/C ratio remained fairly constant at 0.13 +/- 0.03 wt% for both B/P-BOP. The proximate analysis showed that B-BOP and P-BOP have a constant water content of 9.8 +/- 0.18 wt%.

Title: Assessing the effect of seed physiological quality on soybean growth and yield

Primary Author: Maria Leticia Pacheco da Silva

Additional Authors: Eros Francisco

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Soybean [Glycine max (L.) Merr], one of the most important grain crops grown around the world, plays an essential role in food production due to its nutritional value. However, considering the future global food demand, and to ensure food security for all, soybean yield must be accelerated. Closing yield gaps, the process of reducing the difference between actual and potential yields, can be obtained by changes in agricultural management practices such as the use of improved seed quality. Seed quality is fundamental for crop establishment and performance. Therefore, to achieve maximum soybean yields, an adequate supply of high-quality seed is essential. The main factors affecting seed physiological potential include germination and vigor. In soybeans, the most concerning seed quality problems are related to losses in germination and vigor, which can lead to poor field emergence and inadequate plant population. The objective of this work was to evaluate the performance of soybean plants and grain yield in response to different seed physiological quality levels. Soybean seeds were submitted to accelerated aging to obtain different seed quality levels (high, medium, and low). A field experiment was conducted in a randomized block design with five replicates at three locations. Plant population density, plant height, distance between plants, leaf area index, and grain yield were evaluated. Overall, low-quality seeds led to lower plant population density, resulting in higher distance between plants at some locations. Leaf area index and grain yield did not vary significantly with the treatments.

Title: Determining feed spillage of broilers using two commercial feeders and two supplemental feeders during the starter phase

Primary Author: Martha Sabine Rueda Lastres

Additional Authors: Bethany Baker, Cody Smith, Jesse Campbell, Carson Edge, Jessica Starkey, Jeremiah Davis

Department/Program: Poultry Science

College: College of Agriculture

Abstract: As of right now, it is unknown how much feed broilers spill during a growout. Feed spillage has been reported to be observed but not quantified; thus, a method was developed to quantify feed spillage at the different growth phases. The following study focused on determining feed spillage in broilers during the starter phase (0–15 days (d)) using two commercial feeders and two supplemental feeders. Experimental treatments were: 1) C2 feeder only (C2); 2) C2 feeder and Turbo supplemental feeder (C2TO); 3) C2 feeder and Tray supplemental feeder (C2TY); and 4) Konavi feeder only (KON). Supplemental feeding through Turbo and Tray feeders was offered from 0 to 6 d, simulating commercial production practices. A total of 1,200 d old chicks were randomly allocated to floor pens with 30 birds per pen and 10 replicate pens per treatment. Feed spillage was collected on days 3, 6, 9, 12, and 15. Birds and feeders were weighed on days 6 and 15 to calculate feed intake (FI), body weight (BW), and feed conversion ratio (FCR), all corrected for mortality. Data was analyzed as a one-way ANOVA; means were separated using the PDIFF option of SAS V9.4 GLIMMIX with statistical significance considered at $P \leq 0.05$. For the first week of age, broilers were heavier ($P<0.05$) when fed using C2TO, C2TY, and KON compared to C2. Feed intake was higher ($P<0.05$) when using C2TO and C2TY compared to KON and C2. Birds using C2 had a higher feed conversion ratio than C2TY, which was different (<P0.05) from KON. Total feed spillage and spillage rates (g/hr and g/day) at the end of the first week were not significantly different among treatments. After two weeks, BW and FCR of birds among the different treatments were not significantly different. However, birds fed using C2TO, C2TY, and KON consumed more feed compared ($P<0.05$) to the C2 treatment. At the end of the starter period, total feed spillage and spillage rates were higher ($P<0.05$) when using KON and C2 compared to C2TO but similar to C2TY.

Title: Application of Artificial Intelligence in future psychosis healthcare approach

Primary Author: Mary Hill

Additional Authors: Muralikrishnan Dhanasekaran, Courtney Alexander, Preston Cook, Keyi Liu, Suhrud Pathak, and Courtney Alexander

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Every year, the incidence and prevalence of mental diseases rise. There has been a spike in drug usage, loneliness, and suicidal ideation because of the COVID-19 pandemic. Psychosis is a common, debilitating symptom of many psychiatric, neurodevelopmental, neurological, and medical diseases. It is a significant area for research in neurologic and psychiatric practice. Implementing artificial intelligence (AI) in the medical field has become more prevalent as healthcare providers look to maximize their efficiency in their practices and discover and develop new drugs. Not only does this save time for the physicians, but it also helps organize patients' electronic data, such as their genomics and allergic conditions, leading to more individualization that can help reduce morbidity and mortality and improve therapeutic efficacy. Moreover, it can ease the process and aid researchers in discovering or developing novel pharmacological agents and therapeutic, diagnostic, or preventive approaches. AI can help traverse the gap between the two and interpret a multitude of simultaneous, real-time data sets. From subjective interpretations to reading MRI scans, AI can instantly convert raw data into significant readings. AI has been coupled with machine learning to develop discriminatory factors to create a learning algorithm that continuously becomes more efficient, which helps in the early detection and prevention of patients with psychosis. AI also supports the accurate differentiation of other illnesses that have symptoms similar to psychosis, such as dementia and Alzheimer's disease. Currently, through the analysis of neural signatures, AI and machine learning are advancing therapy for psychosis, especially with suicidal ideation. Ultimately, physician-patient interaction, drug discovery, and precise drug dosing will become more cost-effective and methodical as AI and machine learning evolve.

Title: Indications of soil reduction in headwater wetlands using IRIS tubes

Primary Author: Mary Hughes

Additional Authors: Thorsten Knappenberger and Christopher Anderson

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Recent urban and agricultural development in Baldwin County, Alabama, has impacted headwater wetlands and the drainage they receive. This research aims to determine how wetland functions are potentially affected by surrounding land use. A study was designed to observe the tendency of headwater wetland soils to develop anaerobic conditions by using IRIS (Indicator of Reduction in Soils) tubes. To produce IRIS tubes, specialized paints are mixed that are infused with iron and manganese oxides and painted onto tubes made from a thin plastic film (3.7 cm wide and 60 cm long). These films are painted beforehand, rolled in the field, and then inserted into a vacated soil core. After four weeks of being in wetland soils with anaerobic conditions (typical of headwater wetlands), the IRIS tubes are expected to yield a decreased amount of iron and manganese as it is lost to solution under flooded, low-oxygen conditions. Five iron- and five manganese-IRIS tubes were deployed into nine headwater wetland sites in Baldwin County, Alabama. These sites are affected by a range of surrounding land use typical for the region. An initial deployment was conducted for four weeks in November 2023 – December 2023. After the tubes were retrieved, they were cleaned and scanned to eventually determine the amount of iron and manganese-based paint remaining. Initial observations from the tubes showed tremendous variation between sites. Site 7 (an urban wetland) resulted in the most paint loss in both iron and manganese, whereas site 9 (also urban) resulted in the least. Between these extremes, there was a range of paint loss among the other sites. Future analyses will quantify paint loss and relate results to watershed land use. Repeated IRIS tube deployments are planned in 2024 to determine seasonal changes as well. Initial indications from our IRIS tubes show a shift in wetland soil conditions affected by urban and agricultural land use compared to reference conditions.

Title: Relationship between climate change and the American criminal justice system with a focus on Alabama

Primary Author: Maryam Saulawa

Additional Authors: Tierra James

Department/Program: Sociology

College: College of Liberal Arts

Abstract: Despite the vast amount of research on climate change and its macro effects on society, the relationship between climate change and the criminal justice system has largely been overlooked. In this analysis, we explore the general impact of climate change on adverse health outcomes, food and water shortages, migration, and social conflict over resources, highlighting the relationship between increased temperatures and increased crime. By examining the historical roots of capitalism, slavery, and exploitation in America with a focus on Alabama, we aim to understand how this system perpetuates inequalities. We found that the race-based discrimination that underpins American society is linked to the inadequate response to climate change, which will disproportionately affect marginalized communities, primarily minority populations. As a response, there are recommendations for a reconceptualization of environmental injustice as a crime, drawing attention to the urgency of ecological racism's harm. Some solutions include criminalizing ecocide internationally, de-privatizing prisons, using more precise language to describe environmental issues, adopting cliodynamics to quantify impact, and advocating for degrowth. It is crucial to implement comprehensive and systemic changes to address the interconnected issues of climate change and the criminal justice system, ensuring a sustainable future for all.

Title: Finite-Difference Approximation of Periodic Radiative Heat Flux with Convective Cooling

Primary Author: Mason Corbett

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: A system is being developed to test material responses to the periodic radiative heat flux generated within an internal combustion engine (ICE) cylinder. A graphite resistive heating element will be used to generate heat, while a “chopping wheel” will be used to replicate the periodic nature of ICE combustion events. Coaxial thermocouples containing two junctions will be used to capture transient aspects of the heat transfer within the system. The thermocouples should capture a sawtooth-shaped temperature trace whose running average should increase for some period then level off to some steady-state time-based average. The height of these sawtooth peaks should exceed the uncertainty of the thermocouples. Failure to meet this condition would necessitate design alterations to increase the view factor between the heating element and the thermocouples. To support design decisions, a finite-difference approximation was built to predict the response of the thermocouples. This work demonstrates the effectiveness of the finite-difference model. To date, the model has met expectations, creating trends that fit the predicted shape. Based on insights gathered from the model, component redesigns have been implemented. The total thickness of the chopping wheel was reduced. Mesh sensitivity is being evaluated, and further work will create a more rigorous view factor calculation. The effectiveness of the model will be tested using real data from the completed testing apparatus.

Title: Word embeddings revisited: Do LLMs offer something new?

Primary Author: Matthew Freestone

Additional Authors: Shubhra Kanti Karmaker Santu

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Learning meaningful word embeddings is key to training a powerful language model. The rise of Large Language Models (LLMs) has provided us with many new word embedding models recently. Although LLMs have shown remarkable advancement in various NLP tasks, it is still unclear whether the performance improvement is merely because of scale or whether underlying embeddings they produce are significantly different from classical encoding models like Sentence-BERT or Universal Sentence Encoders. In this paper, we systematically investigate this issue by comparing classical embedding techniques against LLM-based embeddings in terms of their latent vector semantics. Our results show that LLMs tend to cluster semantically related words more strongly than classical models. These models also have higher average accuracy on BATS across multiple methods for the analogy test. Finally, certain LLMs tend to rank words by similarity relatively closely to SBERT, a comparatively much simpler model.

Title: Platelet lysate affects canine keratinocyte proliferation, migration and chemotaxis

Primary Author: Matthew Murray

Additional Authors: Maria Naskou, Scarlett Sumner, Emily Davis, and Thaina Lunardon

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Platelets and various platelet-containing products have been shown to affect tissue regeneration and modulate inflammation. These products include platelet-rich plasma (PRP), platelet lysate (PL), platelet gel, and fibrin glue which exhibit various bioactive effects based on their preparation and contents. Platelets serve as source of various growth factors, chemokines, and antimicrobial compounds that can be used to aid the process of wound healing. Topical PL has shown promising benefits for wound healing in human and mouse cells *in vitro* by promoting cell migration, keratinocyte epithelialization, and regulating fibroblast matrix deposition. However, no studies are available evaluating their effect on canine wound healing. The aim of this study is to compare *in vitro* the effect of platelet lysate on the proliferation, chemotaxis and migration of canine keratinocytes. Platelet lysate (PL) was prepared from whole canine blood according to established protocols. Subsequently, different preparation methods of platelet lysate were evaluated, and those included platelet pellet lysate (PPL), heat-inactivated platelet lysate (hPL), and heat-inactivated platelet pellet lysate (hPPL). The above treatments (10 or 20%) were added to canine keratinocytes in the presence of standard culture media. Proliferation, chemotaxis and migration of canine keratinocytes in the presence of the above treatments was assessed after 24 and 48 hours and as previously demonstrated. Our results indicated the accelerated ability of platelet-derived products to accelerate the proliferation, chemotaxis, and migration ability of canine keratinocytes. These results are especially encouraging for the future clinical application of platelet-derived products for the treatment of chronic wounds in dogs.

Title: Kinematic predictors of horizontal and vertical release angle for division one baseball pitchers

Primary Author: Matthew Poczatek

Additional Authors: Gretchen Oliver, Adam Nebel, Benjamin Lerch, and Billy Lozowski

Department/Program: School of Kinesiology

College: College of Education

Abstract: Locating the ball is a critical component of a pitcher's performance. Research shows that projection angle has the greatest influence on a throw's location at target, yet limited literature exists on the relationship between release angles and kinematics. This study investigated kinematic predictors of vertical (VRA) and horizontal (HRA) release angles during division I collegiate baseball games. Kinematics for 77 pitchers (1.88 m [0.06]; 91.6 kg [9.2]) were captured using an 8-camera markerless motion capture system (KinaTrax Inc., FL, USA; 300 Hz). Ball flight metrics were recorded with a trackman V3 game tracking stadium unit. Kinematic and ball metric data were averaged for each pitcher, and variables exhibiting a significant relationship with VRA or HRA were included in two forward stepwise regressions (alpha = .05). Seven variables accounted for 69.4% of the 20 variance in VRA ($R2$ = .694; F (7,69) = 22.362; p < .001), whilst three accounted for 43.2% of the 20 variance in HRA ($R2$ = .432; F (3,69) = 18.531; p < .001). VRA significant predictors were: Trunk lateral flexion at foot contact (FC); trunk lateral flexion at maximal external rotation (MER); shoulder abduction angle at MER; displacement of the center of mass (COM) in the anterior-posterior direction at ball release (BR); elbow pronation at BR; ball velocity; and the timing of maximal knee extension velocity relative to BR. HRA significant predictors were: Pelvis tilt at FC; COM velocity in the medio-lateral direction at FC, and shoulder abduction angle at MER. Biomechanics appear to be key determinants of ball release angles during baseball pitching. Understanding this relationship will make it possible to determine which variables might be manipulated to improve ball projection towards target. For example, trunk lateral flexion might be used to alter VRA, whilst increasing shoulder abduction at MER may be used for either VRA *or* HRA.

Title: Which came first, the money or the sex? Bidirectional, indirect associations between financial management behaviors and sexual satisfaction among newlywed couples

Primary Author: Matthew Saxey

Additional Authors:

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Scholars have established connections between how married couples navigate their finances and their sexual relationship. For example, financial management behaviors are associated with sexual satisfaction among newlywed couples. However, we know very little about the direction of the association between financial management behaviors and sexual satisfaction. Understanding which might predict the other, or if there might be a bidirectional association between the two, could provide information on where to intervene to help newlywed couples with financial or sexual obstacles in their marriage. With three waves of dyadic data (N = 1,205 U.S. newlywed couples), I used structural equation modeling to examine the bidirectional, indirect associations between husbands' and wives' financial management behaviors and their own sexual satisfaction through their own marital satisfaction. Overall, I found that financial management behaviors indirectly predicted changes in sexual satisfaction through marital satisfaction for both husbands and wives. I also found limited evidence that husbands' sexual satisfaction indirectly predicted changes in their own financial management behaviors through their own marital satisfaction. Additionally, these indirect associations differed by gender. Partner effects, however, were largely non-significant. Implications of these findings for those who help newlywed couples with their sexual relationships will be discussed.

Title: SMU: 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, which grade the similarity of two documents, tend to be black boxes through their complexity. 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. Thus, while achieving comparable performance to other metrics, we hope to allow greater explainability for document similarity metrics while also paving the way for further improvements in the domain.

Title: Fruit yield and quality evaluation of two strawberry (Fragaria x annanasa Duch.) cultivars under drip hydroponics

Primary Author: MAVERICK MARIQUIT

Additional Authors: Bernardo Chaves-Cordoba, and Melba Salazar-Gutierrez

Department/Program: Horticulture

College: College of Agriculture

Abstract: There are several studies conducted on evaluating the growth and yield performance of the two cultivars, however, there were no specific studies comparing these two cultivars in a drip hydroponics system. Therefore, the objective of the study is to evaluate the yield and fruit quality performance of 'Albion' and 'San Andreas' in a drip hydroponics. Two day-neutral strawberry cultivars 'Albion' and 'San Andreas' have been grown since September 15, 2023, and while the study is on-going, preliminary data is until January 31, 2024. Harvest is performed three times a week. Quality evaluation including brix, firmness, fruit length, and diameter is measured every week. The biomass is determined using dry weight of 15 fruits per cultivar and fruit quality parameters were done. In terms of yield, preliminary data suggest that 'San Andreas' is higher than 'Albion'. 'San Andreas' also has shown higher fresh fruit mass, total harvest and marketable weight as well as the total and marketable fruits than 'Albion'. A positive correlation of non-marketable weight and number is found. Fruit length, diameter and firmness are higher in 'San Andreas' than in 'Albion' while 'Albion' has higher brix than 'San Andreas'.

Title: Sexual selection in the wild inferred using 3-D printed decoys and PIT tags: male mate choice in yellow-bellied slider turtles (*Trachemys scripta*)

Primary Author: McKae Sarkowski

Additional Authors: Iwo Gross and Matt Wolak

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Mate choice is central to sexual selection, and there is a lack of knowledge regarding male mate choice specifically, despite it being one of the drivers of adaptive evolution and speciation. Mate choice studies have scarcely been conducted in turtles because of the difficulty of observing mating behaviors that occur in water. With developments in technology, observing potential patterns in male mate choice in freshwater turtles has become increasingly feasible. Using two 3D-printed female decoys of differing sizes, we are testing whether male yellow-bellied slider turtles (*Trachemys scripta*) prefer to interact with females of larger sizes over smaller sizes when given a choice between the two. Each decoy is fixed with a passive integrated transponder (PIT) tag reader that records when previously PIT-tagged males approach either decoy within close range (<40cm). By choosing a female of larger size, males should increase their reproductive success due to body size being associated with increased fitness. This novel approach to mate choice study offers a realistic context in which observing mating behaviors in the wild is feasible with conditions that are not traditionally ideal.

Title: How the use of artificial intelligence can impact medical approaches to movement disorders

Primary Author: Mckenzie Milstead

Additional Authors: Muralikrishnan Dhanasekaran, Courtney Alexander, Preston Cook, Keyi Liu, Suhrud Pathak, and Bernadette Elder

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Movement disorders are neurological conditions that affect a person's ability to control their movements, and early and accurate diagnosis is crucial for effective treatment. Artificial intelligence (AI) has made significant advancements in the early diagnosis of movement disorders by leveraging various technologies and data sources. The integration of AI into the field of neurology is revolutionizing the way of diagnosing, monitoring, and treating movement disorders. Early detection, diagnosis, personalized treatment plans, and ongoing monitoring are becoming more attainable, improving the quality of life for patients, and offering hope for better therapeutic outcomes. While AI offers remarkable potential, it is crucial to maintain a collaborative approach, combining the power of AI with the expertise of healthcare professionals to deliver comprehensive care to those affected by these challenging conditions. Ethical considerations, data privacy, and regulatory oversight are essential factors to navigate as AI continues to evolve in the field of neurodegenerative movement disorders. As technology continues to advance, the synergy between AI and healthcare promises a brighter future for individuals affected by these debilitating conditions.

Title: Large language models as your personal data scientist

Primary Author: Md Mahadi Hassan

Additional Authors: Shubhra Kanti Karmaker Santu, and Alex Knipper

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Large Language Models (LLMs) have contributed to massive performance improvements for various language understanding and generation tasks; however, their limits are yet to be fully explored for "ill-defined" complex tasks. One such task is conversational data science, where a user can talk to an intelligent agent to explain their data science needs, and the agent will serve the user by engaging in a conversation with them like any human data science would do and, accordingly, formulate and execute precise Machine Learning tasks. Although this is a very ambitious goal, given the recent developments in LLMs, a fully functional conversational data science system seems quite achievable in the near future. Through an in-depth case study in this paper, we delved into the potential of employing LLMs as a solution to conversational data science. We hope that our findings will not only broaden the horizons of NLP research but also bring transformative changes in future AI technology.

Title: A high-throughput phenotyping system evaluating salt stress tolerance in kale plants cultivated in aquaponics environment

Primary Author: Md. Hasibur Rahman

Additional Authors:

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Monitoring plant growth in a controlled environment is crucial to make informed decisions for various management practices such as fertilization, weed control, and harvesting. Agronomic, physiological, and architectural traits in kale plants are important to producers, breeders, and researchers for assessing the performance of the plants under biotic and abiotic stresses. Traditionally, architectural and morphological traits have been used to monitor plant growth. However, direct measurement of these traits is time-consuming, labor-intensive, likely inaccurate, and often fails to provide information for decision-making. This study assessed the feasibility of a plant growth monitoring system to estimate and forecast kale plants growth under salt stress. Two greenhouse experiments were conducted across two seasons on kale plants in a hydroponic system. The plants were arranged in split and single-root configurations and were subjected to varying levels of salt treatments. Top-view images of plants were collected using GoPro and Raspberry Pi cameras. Different YOLOv8 instance segmentation model variants were trained on four different image datasets to detect and segment plants. Morphological traits such as area and major and minor axes were extracted to automate the measurement of canopy area, horizontal and vertical lengths. Results showed that the instance segmentation model is well generalized and achieved mAP50 for bounding box and mask in the range of 0.897 – 0.952 and 0.896 – 0.947, respectively. Plants with split-root systems showed higher growth than single-root plants even under the highest salt stress level. Comparison between physical measurement (horizontal and vertical length) and image parameters (major and minor axis) obtained the highest R2 of 0.85 and 0.92 for single-root systems and 0.90 and 0.84 for split-root. Area parameters were used to forecast plant growth using an autoregressive integrated moving average (ARIMA) model for 2-, 4-, and 8-days windows and evaluated using mean average percentage error (MAPE).

Title: Effects of multiple crop plastic mulching on SE US vegetable production

Primary Author: Melanie Hill

Additional Authors: Andre Luiz Biscaia Ribeiro da Silva and Paul Bartley

Department/Program: Horticulture

College: College of Agriculture

Abstract: Plastic polyethylene mulch is widely used in fruit and vegetable production in the southeast US, offering short-term benefits to soil ecosystem services. However, its removal is costly, leading to double, triple, or quadruple cropping on the same mulch. This study investigates the impact of successive plastic mulching on soil properties and vegetable yield. Soil compaction, water content, and temperature were measured at 0, 20, and 40 days after planting (DAP), along with zucchini and yellow squash biomass. Results indicate no significant compaction differences between double and triple cropping at 0 and 20 DAP, but compaction increased with successive use by 40 DAP. Soil temperature rose with multiple cropping, and water content decreased significantly compared to single cropping. Single cropping yielded the highest biomass. This research sheds light on balancing the benefits and drawbacks of repeated plastic mulch use on soil quality and crop yield.

Title: Evaluation of canine platelet lysate antimicrobial activities in vitro

Primary Author: Melikasadat Mollabashi

Additional Authors: Maria Naskou, Scarlett Sumner, Thaina Lunardon, Matt Murray, and Alonza Klopfer

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Platelet lysate (PL) is an acellular platelet derived product rich in growth factors and cytokines. Topical application of PL accelerates the process of wound healing in canine. Additionally, PL holds antimicrobial properties, having an effect on the clinical management of bacterial infected wounds. However, the preparation process and composition of the final product can affect their antimicrobial potential. Our goal was to compare the antimicrobial activity of canine PL produced by two methods against common bacteria in canine wounds. Our hypothesis was that the leukocyte concentration in the final product as well as the presence of plasma and complement will affect bacteria growth in vitro. Whole blood was collected from three healthy dogs. Platelets were concentrated using two distinct centrifugation methods, a leukocyte poor and a leukocyte rich method. Subsequently a portion of the generated platelet concentrate underwent plasma depletion. Different preparations were pooled equally between donors. Finally, PL was generated from the above preparations via five freeze-thaw cycles and complement was inactivated (H) for a portion of PL via heating at 56℃. The same steps were taken for generating products that were poor in platelets (negative control). The antimicrobial effect of different platelet preparations was evaluated via a bacterial spiking assay against bacteria commonly isolated in canine wounds at 3 and 24 hours of incubation. The log reduction was calculated based on the number of bacteria colonies cultured in Brain Heart Infusion (BHI) media. Our results show canine PL has potent antibacterial action against bacterial strains often encountered in canine wounds. However, the generation method and presence of complement can affect these antimicrobial properties. Future studies evaluating the growth curve dynamics of bacteria exposed to platelet products.

Title: Exploring links between individual and social factors and mental health among service members who experienced military sexual trauma

Primary Author: Melissa Garnes

Additional Authors: Mallory Lucier-Greer and Erin Cooper

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Military sexual trauma (MST) refers to sexual assault or harassment that occurs during one's military service and can threaten service member well-being and readiness. Though MST may be underreported due to fears of retaliation, prevalence estimates suggest that 15-40%%20of women and 1-4%%20of men have experienced MST on post-9/11 deployments and that women and racial minorities are at a greater risk of MST than men or white Service members. Using a social-ecological lens, data from the Army STARRS All Army Study were used to conduct within group analyses of 114 service members who had experienced sexual assault on deployment to understand how individual factors (sex and race) and social factors (mental health support and unit cohesion) contribute to current mental health symptoms (anxiety and depression). Analyses of variance (ANOVAs) results suggest that there were no differences in depressive or anxiety symptoms among MST survivors based on their sex or race (individual factors), but those with greater mental health support and unit cohesion reported fewer depressive and anxiety symptoms compared to those who reported less mental health support and less unit cohesion (social factors). Using multiple linear regression, this study also explored additive associations between mental health support and unit cohesion, two malleable and protective factors, on mental health symptoms. Having received greater mental health support and higher unit cohesion were both uniquely linked to lower depressive and anxiety symptoms. Overall, results suggest that protective, social factors may be more salient in understanding the current mental health symptoms of service members who experienced sexual assault while deployed compared to individual level factors. In addition to MST prevention efforts, stakeholders may consider implementing policies and interventions focused on promoting mental health help-seeking and unit cohesion to mitigate risks to mental health due to deployment MST.

Title: Can gender and sexual minority individuals benefit from General CRE?: Exploring relational and individual outcomes

Primary Author: Menglin Wei

Additional Authors: Francesca Adler-Baeder;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: An increasing number of U.S. adults identify as sexual and gender minorities (SGM). Recent national surveys reveal that 7.2% of U.S. adults identify as SGM and there were more than 1.2 million queer couple-headed households in the U.S. Despite the queer community's growth and strengths, there are unique challenges faced, such as lower family support, minority stress, individual and couple level discrimination, and lower levels of mental and physical health. Understanding this population's experience better and advancing social services that they might find helpful is critical. Couple relationship education (CRE) is one of the primary prevention methods targeting couples' relationship functioning, and various CRE programs have been widely implemented nationwide for decades. Although CRE has long-established effectiveness in aiding couples' relational and individual outcomes, research on CRE and SGM populations is scarce despite the long-standing call for providing services for SGM individuals and creating an affirming environment for them in CRE programs. Using a community sample, the current study investigates the baseline differences between SGM and non-SGM participants in a general CRE program in demographic characteristics, relationship quality, skills, and mental health symptoms. Results show that SGM and non-SGM program participants have similar levels of relationship functioning and skills before participating in a general CRE program, but SGM participants have worse mental health symptoms, on average. Planned analyses for the Symposium will use propensity score matching and growth curve modeling to investigate comparative growth in individual and relationship functioning over six months for SGM and non-SGM individuals participating in a "general" CRE with non-specialized content. This study contributes to the field of CRE by centering the experiences of SGM individuals and determining whether broadly-offered CRE can be helpful.

Title: Development and optimization of a phase I and phase II metabolites identification approach: Case of bioactive açaí constituents.

Primary Author: Meredith Almy

Additional Authors: Angela Calderon, and Zarna Atul Raichura

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Euterpe oleracea Mart. (açaí) is a palm fruit from a tropical palm tree belonging to the Areicaceae family. Botanical Drug Supplements (BDS) from açaí fruits are highly consumed worldwide due to their antioxidant and anticarcinogenic effects. Recent statistics show that cancer patients use BDS at a much higher rate than non-cancer patients in order to complement their conventional chemotherapeutic medications. The Food and Drug Administration Adverse Event Reporting System (FAERS) showed adverse events associated with concomitant use of BDS of açaí and anticancer drugs. For this reason, it has proven necessary to explore the mechanisms of action that cause these clinically relevant drug interactions. The main objective of our study is to develop a predictive preclinical approach to identify Phase I and II metabolites of the constituents of açaí extracts. Subsequently, elucidate the corresponding metabolite structures using mass spectrometry and biotransformation tools. The study focuses on predicting the metabolites of cyanidin 3-glucoside, as this compound is used to standardize açaí extracts and is the only compound with reported pharmacokinetic studies. Based on the biotransformation software, the predicted Phase I metabolism pathway involves dealkylation, dehydrogenation, quinonation and/or hydroxylation of benzene rings. The potential cytochrome P450 enzymes responsible for the observed metabolism are CYP1A2, CYP2C9, CYP2D6, and CYP3A4. In contrast, the Phase II metabolites entail O-glucuronidation or O-sulfation of the hydroxyl groups in the molecule, carried out by UDP glucuronosyltransferase and sulfotransferase. Confirmation of these metabolites using LC-MS/MS will be employed, which is currently underway.

Title: Development of a multiple linear regression (MLR) model for copper toxicity to phytoplankton

Primary Author: Michael Mcdonald

Additional Authors: Alan Wilson, Tham Hoang, Sathya Sandarenu Ganegoda, Suzanne Tenison, Kate Merrill, Matthew Gladfelter, Peyton Poe, and Ashley Hennessey

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Copper-based algaecides have been used extensively over the last century to control harmful algal blooms (HABs) in freshwater systems; however, their application can cause deleterious non-target effects on community structure and ecosystem functioning. Traditional dosing methods are based on the total alkalinity of a waterbody, which can be effective, however, it is not based upon experimentally derived data. This study aimed to develop a novel, science based, predictive multiple linear regression (MLR) model that can be used to determine an optimal algicidal dose that minimizes non-target effects on other organisms, such as zooplankton and beneficial green algae. This model was developed from a series of comprehensive bioassays relating key water quality parameters including pH, hardness, alkalinity and dissolved organic carbon (DOC) to algal toxicity. Rigorous testing found that DOC and pH were the most important predictors of toxicity to phytoplankton as an increase of these parameters was seen to result in significant decrease in copper toxicity. To test the model, a field-based validation was carried out using a replicated, 28-day experiment in 1200L enclosures. Results from this validation show that the MLR derived dose resulted in almost identical harmful algal control to traditional dosing methods while using up to 85percentage less copper. In addition, preliminary results suggest that the MLR dose may cause less harm to zooplankton and beneficial green algae than traditional methods. These results hold promise in the development of more sustainable water management practices that allow for harmful algal control while also preserving ecosystem health.

Title: Prenatal cannabinoid exposure leads to enhanced GABAergic signaling resulting in learning and memory deficits in adolescent rat offspring

Primary Author: Miles Wiley

Additional Authors: Miranda Reed, Vishnu Suppiramaniam, Warren Smith, Tia Daniels, Iva Durdanovic, Emma Redmon, Adrian Courville, and Kawsar Chowdhury

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Cannabis is the most abused drug by pregnant women. Its use is expected to increase, with 39 states having medical marijuana laws and 19 having recreational marijuana laws. Also troubling, the concentrations of tetrahydrocannabinol (THC) in cannabis have doubled worldwide over 40 years, and higher concentrations are likely to increase associated problems. Clinical data showed that when pregnant women use cannabis, their offspring have learning and memory deficits. We hypothesize that PCE increases GABAergic signaling, resulting in synaptic plasticity and memory deficits. In the current study, pregnant dams were exposed to a vaporized drug solution of Δ9-THC 100mg/mL in PEG400 via passive inhalation prenatally from gestational day 5 to 21/22. PK studies revealed the THC detected in dams to be consistent with a moderate dose of THC in humans, and THC was present in the brain and plasma of pups immediately after birth. In addition, pregnant dams exposed to THC gained significantly more weight and ate more food during treatment than vehicle-exposed pregnant dams. THC-exposed offspring weighed significantly less from postnatal day 1 to 40. THC exposure also resulted in deficits in the novel object recognition paradigm, indicating impairments in long-term memory. THC offspring also exhibited increased anxiety levels in the elevated plus maze task. These deficits were associated with alterations in GABAergic proteins in the hippocampus and medial prefrontal cortex. These experiments help elucidate how GABAergic dysfunction may lead to behavioral alterations in PCE offspring.

Title: Validating the “Anti-insomnia” properties of the natural bioactive “Zeaxanthin”

Primary Author: Miranda Correia

Additional Authors: Muralikrishnan Dhanasekaran, Suhrud Pathak, and Keyi Liu

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Blue light is produced naturally by sunlight and has a comparatively shorter wavelength than other colors, typically within the 415-455nm range. However, it is also produced artificially by commonly used technological devices such as computers, phones, and televisions. Research has shown that blue light induces adverse effects on humans by altering the metabolism of neurotransmitters, leading to retinal damage, eye cancer, insomnia, and other central and peripheral pathologies. Thus, the increasing abundance of blue light in our daily lives has been proven to cause insomnia and drastically threaten human health. The current therapeutic approach for insomnia is significantly associated with several adverse drug reactions and iatrogenesis. Therefore, there is an imminent need for a potent pharmacological approach with minimal adverse drug reactions. Zeaxanthin is a carotenoid found naturally in the human eye, egg yolks, and leafy vegetables (kale, spinach, and broccoli). Zeaxanthin exhibited antioxidant, anti-inflammatory, and other protective effects against age-related macular degeneration and other optical disorders. Based on the existing literature, this study primarily evaluates the anti-insomnia action of the natural bioactive Zeaxanthin. The current hypothesis is that Zeaxanthin can significantly reduce the toxicological impacts of blue light and, therefore, reduce insomnia symptoms. The expected results in this study are that supplements of Zeaxanthin significantly increase melatonin and decrease neurophysiologic arousal, resulting in decreased insomnia.

Title: Correlation of mechanical and microstructural evolutions in lead-free solders subjected to various thermal exposures

Primary Author: Mohammad Al Ahsan

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: During the service life and accelerated life testing, solder joints in electronic assemblies are routinely subjected to different thermal exposures in which the temperature ranges from very low to high. While changes in solder materials during isothermal aging at fixed temperatures have been examined in detail in our prior studies, limited studies have examined material evolution occurring during other thermal exposures such as thermal cycling and thermal shock. In the current investigation, we have investigated the microstructure evolutions occurring in lead-free solders subjected to several different thermal exposure profiles (thermal cycling, ramping, and aging). The observed changes in microstructure were then correlated with our previously measured mechanical property and creep behavior evolutions. Correlations of the observed microstructure evolutions with the corresponding changes in mechanical properties and creep behavior were performed for each alloy, and it was demonstrated that the Ag3Sn IMC particle size (diameter) was the most significant characteristic of the microstructure that controls the SAC lead-free solder mechanical behavior. More importantly, it was observed that for a given alloy, the mechanical property degradation depended on the IMC particle diameter in the same manner irrespective of the thermal profile that caused the mechanical and microstructural evolutions (see included Figure). This suggests that a single curve/relation can be used for each alloy to correlate mechanical behavior and microstructure, independent of the thermal history seen by the solder. We are further testing this hypothesis with additional thermal profiles and the results look promising. If true, one need merely look at the microstructure of the solder to know its mechanical behavior.

Title: Enhancing predictions of geochemical reaction rates through integrated mineral accessible surface area analysis

Primary Author: Mohammad Kariminasab

Additional Authors: Lauren Beckingham, Nora Rivera, Jamie Newsome, Otis Williams, Abdullah Al Nahian, Harrish Kumar Senthil kumar, Md Fahim Salek, and Mitra Abbaspour.

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Predicting geochemical reaction rates requires determining mineral reactive surface area. Various methods, such as Brunauer Emmett Teller (BET) adsorption, geometric approximation, and imaging, are used for this purpose. However, different methods often yield vastly different results, ranging from one to five orders of magnitude. Including these variations in reactive transport, models can have a significant impact on expected reaction rates. Recent research suggests that integrating 2D and 3D imaging techniques can improve agreement with observed reaction rates in experiments involving core-flood experiments. There are limitations in analyzing clay materials due to the XCT picture resolution. To overcome the cavity restrictions in the combined imaging technique, we employ the BET surface area of pure clay mineral phases and the accessibility ratio of these minerals to estimate the accessible surface area. The results indicate while this method significantly increases the total surface area in samples with high clay content, it has no effect on samples with low clay concentration. Six new sandstone samples with various compositions were included in the investigation, together with data from seven previously investigated samples. BET tests conducted on intact samples reveal that the total surface areas estimated using this method align with those obtained from BET surface area measurements on intact samples.

Title: Enhancing engineered cardiac tissue maturity for studying diabetic cardiomyopathy

Primary Author: Mohammadjafar Hashemi

Additional Authors: Elizabeth Lipke, Rajesh Amin, Alison Brown, and Emma Kim

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Human induced pluripotent stem cells derived cardiomyocytes (hiPSC-CMs) are commonly used to study cardiac disease mechanisms, but modeling metabolic disorders like diabetic cardiomyopathy (DCM) is challenging due to cellular immaturity. We created engineered cardiac tissues (ECTs) by encapsulating hiPSCs in PEG-fibrinogen (PF) hydrogels for in situ cardiac differentiation. To enhance ECTs' metabolic and structural maturation, we used fatty-acid-enriched metabolic maturation (MM) media, emphasizing fatty acid oxidation. We compared MM's impact on hiPSC-CMs with age-matched RPMI/B27 with insulin (RP)-cultured samples. ECTs in MM media exhibited a notable 88% increase in cell elongation, a 527% rise in sarcomere organization score, and a 56% reduction in cell-sarcomere misalignment, compared to RP-cultured samples after one week ($n \geq 43$ cells, $p<0.001$). Our results indicate that MM medium promotes hiPSC-CM maturation, evidenced by alterations in cell shape and sarcomere organization. The mitochondrial area to cell area ratio increased by 1.55-fold and the average distance of the mitochondria from the nuclei showed a 1.2-fold increase in MM compared to RP ($n=34$ cells, $p<0.01$). These findings suggested that MM media promoted mitochondrial biogenesis and influencing their distribution in hiPSC-CMs. ECTs in MM had 73%, 100%, 62% higher maximal respiration rate, spare respiration rate, and ATP production than in RP media, respectively ($n=3$ wells, $p<0.01$) demonstrating enhanced aerobic respiration and ATP production. ECTs in MM exhibited higher contraction and relaxation velocities (2.9 and 3.2-fold), directionality (1.95-fold), and maximal fractional shortening (7.3-fold) compared to RP samples after one week ($n \geq 3$ batches). In conclusion, our study indicated that one week of ECT culture in MM media promoted the structural and metabolic maturation. This strategy provides more appropriate mature model for studying cardiac disease, especially for metabolic diseases like DCM.

Title: Systematic literature review on impacts of Conversational Artificial Intelligence impact on firm brand equity

Primary Author: Mohammed Siddique

Additional Authors: Tahseen Tawseef, and Wis Kwon

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Technological innovation, such as natural language processing, speech recognition, and machine learning adaptability, has enabled machines to converse with humans. An increasing number of firms have been deploying conversational agents with artificial intelligence (AI) with the capacity to converse with customers for personalized services. Enhancing brand equity, or the effects of a brand name in favorably influencing customer responses to a firm's marketing activities, is marketers' ultimate goal. Hence, marketing researchers have exerted efforts to examine linkages between brands' use of conversation AI and brand equity. However, a gap exists in comprehensive insights as to how various ways brands deploy conversational AI influence different facets of brand equity. Addressing this literature gap, we conducted a systematic literature review to synthesize existing findings on the relationships between brands' use of conversational AI and their brand equity. A comprehensive search using the Scopus and EBSCO databases revealed 27 refereed journal articles that reported quantitative empirical research findings related to this topic between 2021 and 2024. Through a content analysis, we identified 16 conversational AI characteristic variables (e.g., AI's conversational ability, AI's experiential value) examined in these articles. Further, these AI variables have been studied in relation to their effects on eight brand equity constructs (e.g., brand awareness, brand attitude, and brand loyalty). To explain these effects, researchers have employed 18 theories, the majority of which originated from the information systems or psychology fields. These systematic literature findings are expected to stimulate future research on the effects of the brand's conversational AI usage on brand equity while offering valuable guidance to industry practitioners seeking to integrate conversational agents into regular business operations.

Title: TDP43-TREM2 interaction is required for clearance of Amyloid beta.

Primary Author: Molly Kleeger

Additional Authors: Rajesh Amin, Sampada Tamhankar, Joyal Xavier, and Meenakshi Singh

Department/Program: Biology

College: College of Sciences and Mathematics

Abstract: Protein aggresomes are centrally associated with the development of neurodegeneration in Alzheimer's Disease and Frontal Temporal Dementia (FTD). The proteinopathies include amyloid beta (Aβ), TDP43 aggresomes, and tau-related neurofibrillary tangles. Recent reports have observed that the Transactive response DNA binding protein 43 kDa (TDP43) protein is involved in the repair of DNA and transcriptional regulation. Further, TDP43 also activates microglia cells, resulting in the clearance of Aβ plaques via interaction with Triggering Receptor Expressed in Myeloid Cells 2 (TREM2). However, little is known as to which form of TDP43 interacts with TREM2 for this protective mechanism. Furthermore, the role of TDP43 regulation in microglial cell activation remains relatively unknown. The current study tests that a full-length form of TDP43 is required for interaction with TREM2 for Aβ clearance. Second, TDP43 aggresomes formed under stress-related conditions prevent TREM2 from functioning. To accomplish this stable expressing microglial cells expressing TDP-43-GFP were created using lenti viral technology. Cells were exposed to LPS for 24 hours. RFP Amyloid beta (1-42) was applied to microglial cells. TDP43 interaction with TREM2 was accomplished by Western analysis and confocal imaging. We observed that LPS induces an increase in TDP43 aggregation and a decrease in TREM2 interaction with TDP43. Further LPS-mediated activation of microglial cells reduced TDP43-mediated LPS-induced activation of microglial cells and reduced Aβ uptake by microglial cells. Future work will focus on potential TREM2 agonists to improve TREM2-TDP43 mediated clearance of Aβ.

Title: The effects of foot and knee kinematics on knee kinetics in youth baseball pitching

Primary Author: Molly Robinette

Additional Authors: Gretchen Oliver;Billy Lozowski;Yuki Yanagita;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Of injuries that keep MLB and MiLB baseball pitchers benched for the longest time, meniscal tears rank tenth and kept pitchers out of play for up to 438 days. Since they are defined as overuse injuries, reducing mechanical load at young age is crucial in preventing meniscal injuries. This study investigated stride leg foot and knee kinematics influencing peak knee adduction moments during youth baseball pitching. Forty youth baseball pitchers who were active on a team roster and injury free for the past six months participated (15.25 /- 1.21 yrs, 72 /- 9.6 kg, 1.77 /- 0.06 m). Participants pitched maximum effort fastballs for strikes at regulation distance. Pitching motion was collected at 100 Hz using an electromagnetic tracking system. Knee kinetics were calculated using an inverse dynamic method in Motion Monitor. The peak knee adduction moment was extracted between stride foot contact (SFC) and ball release. Foot progression angle, knee abduction angle, and flexion angle at SFC were obtained. Multiple regression was conducted to examine the relationship between foot and knee kinematics and knee adduction moment. The overall prediction model was statistically significant (F (3,37) = 8.60, R^2 = .41, p < .01). The analysis revealed that knee abduction/adduction angle (β = -1.8, p <.01) and knee flexion angle (β = 1.5, p <.01) at SFC were predictors for the peak knee adduction moment, but foot progression angle was not (β = -0.7, p =.06). Our work shows a relationship between increased knee abduction angle at SFC and the increased peak knee adduction moment in youth baseball pitchers, which may result in increased compression force on the medial knee compartment. Correcting knee abduction at SFC using cues, strength, and neuromuscular training of the gluteus maximus may reduce the peak knee adduction moment during the pitching motion, therefore reducing the risk of injury.

Title: AAV9 gene therapy as a potential treatment for symptomatic Rabies

Primary Author: Morgan Brannon

Additional Authors: Douglas Martin, Courtney Garrett, Amanda Gross, and Jyoti Yadav

Department/Program: Scott Ritchey Research Center

College: College of Veterinary Medicine

Abstract: If a person develops symptomatic rabies, meaning they failed to receive post-exposure prophylaxis after being bitten by a rabid animal, they are almost guaranteed to die. This is because the rabies virus invades the central nervous system and travels to the brain where it replicates. Because of the blood-brain barrier, which prevents most compounds within the blood from accessing the brain, it is nearly impossible to treat viruses which have entered the brain. This is why there is ongoing research into gene therapies that can penetrate the blood-brain barrier and deliver antibodies to the brain. One of these gene therapies involves an adeno-associated virus known as AAV9. AAV can be genetically engineered to transport genes of interest for expression. There are various types of AAV, the most promising of which for central nervous system gene therapy is AAV9 because it has been observed to naturally bypass the blood brain barrier. In this case, an AAV9 vector was created encoding an antibody against the rabies virus. The goal is for this vector to be administered to a patient with rabies to introduce antibodies into the brain, which will combat the virus. In order to test the antibody production of this method, cats were intravenously treated with either a high dose or low dose of the recombinant AAV9. Since the AAV9 vector is administered to the entire body, not just the brain, its presence in both the peripheral organs and the brain must be studied. Quantitative polymerase-chain reaction (qPCR) was performed to determine distribution of the AAV throughout the brain and peripheral organs.

Title: Development of research tools: In search of heifer fertility biomarkers.

Primary Author: Morgan Young

Additional Authors: Paul Dyce, and Hector Antonio Fajardo Menjivar

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: In the cow-calf industry, unexplained infertility remains a costly issue. If a heifer fails to become pregnant after reaching full reproductive maturity and having multiple opportunities, the cost that it took to raise that heifer is not fully recovered. Usually, replacement heifers are chosen based on genetic and phenotypic qualities. These methods can be useful, but in some cases heifers still fail to become pregnant following their first breeding season. To examine this issue, a group of heifers were put through an estrous synchronization and artificial insemination (AI) program, followed by natural service for two additional estrous cycles. The heifers were then grouped as fertile (pregnant from AI) and sub-fertile (failed to become pregnant). In past research, using samples from heifers, the Dyce lab has identified possible RNA-based molecular targets that were expressed differently in the fertile and sub-fertile heifers. In this project, endometrial samples were collected following the breeding season from heifers deemed fertile and sub-fertile. The protein level expression in the tissue was investigated using Western blotting techniques. The antibodies for the markers of interest were used, and the quantities were compared between the two groups of heifers. This analysis was done using Image Lab software and analyzed with a t-test. Based on the results, there was no significant difference ($P > 0.05$) between the two groups for any of the selected antibodies. The objective of this research is to investigate the differences in protein expression in the endometrial tissue with candidate antibodies between the two groups of heifers with differing reproductive potentials, as well as the acquisition of laboratory and research skills.

Title: Empirical Assessment of Heavy Equipment Theft in the U.S.

Primary Author: Muhammad Umer

Additional Authors:

Department/Program: McWhorter School of Building Science

College: College of Architecture, Design and Construction

Abstract: An American citizen's life revolves around the products of the U.S. construction industry. These products encompass the provision of housing, water, and energy, as well as the facilitation of trade, education, leisure activities, transportation, and communication. With this significant presence in society, the sector is also faced with several challenges. One bleeding end is the theft of inventory from construction worksites. The first step in addressing the problem is quantifying the extent of inventory theft by looking at the data empirically. This study attempts to address this by providing an empirical assessment of theft versus recovery data for equipment by make. The data is sourced from the National Equipment Register (NER) for 2005-16. This study analyzed longitudinal secondary data (2005-16) from the NER and the National Insurance Crime Bureau (NICB). The Dependent-samples Sign-Test was performed at a 0.05 level of significance to test the hypothesis about theft vs recovery ranks. The Null and Alternate Hypotheses were: Ho-There is no difference in the median rankings of theft and recovery. Ha-There is a difference in the median rankings of theft and recovery. The null hypothesis assumes that the factors affecting theft and recovery are equivalent. While the alternative hypothesis argues that the factors influencing theft and recovery are not the same, leading to differences in their rankings. The data analysis stressed the importance for brands to adapt constantly, innovating in both theft prevention and recovery tactics to address the shifting risks and opportunities in the equipment industry. As future work, with the advent of Construction 4.0, the aim is to develop an automated system for inventory management utilizing sensors, IoT, construction robots, and aerial drones. The proposed system will facilitate the theft discovery, especially during off hours when no construction crew is on worksites.

Title: Impact of bird diversity on corn and soybean yields: A national scale analysis

Primary Author: Nabin Bhandari

Additional Authors: Ruiqing Miao;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: The ecological services provided by birds have become a subject of interest in recent years. There are contradictory viewpoints on the relationship between bird diversity and the yield of crops. Current literature derives insights regarding the impact of birds on crop yield based on small-scale field experiments. In addition, the focus of previous literature has been largely on how birds, or separately, pesticides, contribute to farms for increased yield. However, how birds and pesticides interact with each other has received little attention. Utilizing US county-level publicly available datasets of 18 years (1997-2014) that support a national-level analysis, we quantify the impact of the bird diversity while controlling for many other factors that may also affect crop yields, such as pesticide use, fertilizer use, temperature, rainfall, pest pressure, and geographical locations on corn and soybean yields. Preliminary results from panel data instrumental variable (IV) estimators with county fixed effects suggest that grassland bird abundance has a positive impact on corn and soybean yields whereas the impact of insectivorous bird abundance is negative. Furthermore, analysis shows that pesticide decreases the ecological services provided by birds on crop yield. These findings support the re-evaluation of policies permitting the use of pesticides, particularly around the grassland birds' habitats. Insectivorous birds' decreasing crop yields impose a challenge that needs collaboration between interdisciplinary teams to figure out the optimum solution. New technologies that deter insectivorous birds from fields, and federal policies that aim to protect the natural predators of insectivorous birds like hawks can be the two ecosystem-based approaches to increase corn and soybean yield in the US. We are conducting analysis using different diversity measures (richness and Shannon index) and expect these measures to have an impact on the corn and soybean yields.

Title: Semantic Overlap Summarization using Sentence Autoencoders

Primary Author: Naman Bansal

Additional Authors: Shubhra Kanti Karmaker Santu and John Salvador

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Text autoencoders have found applications in conditional generation tasks such as style transfer. Following (Mai et al., 2020), we introduce a plug and play approach in this study. Our approach facilitates the utilization of any pre-trained sentence autoencoders for the purpose of generating semantic overlap summaries (Bansal et al., 2022b). Importantly, proposed operator learns a mapping solely within the embedding space, thereby enhancing the efficiency of the training procedure.The key idea of our framework is to transform the discrete seq-to-seq task into a continuous embedding-to-embedding regression problem. The initial stage involves training an autoencoder model. Subsequently, we introduce the Semantic Overlap Summarization (SOS) operator, which learns to map the embeddings of the two inputs sentences to output sentence embedding. The loss function consists of the task specific loss components alongside an adversarial term, inspired by (Goodfellow et al., 2014), which serves to incentivizes the output vector to remain within the autoencoder manifold. During the inference phase, the decoder component of the autoencoder is utilized to generate the discrete output sentence, leveraging the output generated by the SOS operator. This process ensures that the generated summaries maintain fidelity to the input sequences while adhering to the learned semantic representations encoded within the autoencoder.

Title: A systematic review and meta-analysis of the impact of nature bioactive Cannabis on neuropathology

Primary Author: Nan Pyae Mon

Additional Authors: Courtney Alexander, Muralikrishnan Dhanasekaran, Preston Cook, Keyi Liu, and Suhrud Pathak

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Natural bioactives possess a wide range of chemical structures that can exert a plethora of pharmacological and toxicological actions, resulting in neuroprotection or neurotoxicity. These pharmacodynamic properties can positively or negatively impact human and animal global healthcare. Remarkably, Ayurvedic botanical Cannabis has been used worldwide by different ethnicities and religions for spiritual, commercial, recreational, nutraceutical, cosmeceutical, and medicinal purposes for centuries. Cannabis-based congeners have been approved by the United States of America's (USA) Food & Drug Administration (FDA) and other global law agencies for various therapeutic purposes. Surprisingly, the strict laws associated with possessing cannabis products have been mitigated in multiple states in the USA and across the globe for recreational use. This has consequently led to a radical escalation of exposure to cannabis-related substances of abuse. However, there is a lacuna in the literature on the acute and chronic effects of Cannabis and its congeners on various neuropathologies. Moreover, in the post-COVID era, there has been a drastic increase in the incidence and prevalence of numerous neuropathologies, leading to increased morbidity and mortality. There is an impending necessity for a safe, economically viable, multipotent, natural bioactive to prevent and treat various neuropathologies. The ayurvedic herb, Cannabis is one of the oldest botanicals known to humans and has been widely used. However, the comprehensive effect of Cannabis on various neuropathologies is not well established. Hence, this meta-analysis assessed the impact of Cannabis on various neuropathologies.

Title: Does insight moderate the predictive validity of a neurophysiological indicator of cannabis cue reactivity for predicting behavioral choice?

Primary Author: Natalie McBrayer

Additional Authors: Richard Macatee;Thomas Preston;Brandon Schermitzler;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Cannabis use disorder (CUD) is increasing in the United States, but treatment-seeking is low. Disordered substance use is associated with impaired self-monitoring of one's substance use-related behaviors and their problematic consequences. This insight impairment could affect motivation for treatment, treatment session attendance, long-term abstinence, and substance-related decision making. In a previous study, behavioral insight on a probabilistic choice task moderated the predictive validity of a neurophysiological indicator (late positive potential [LPP]) of cocaine cue reactivity in predicting picture choice behavior. The aim of the current study is to replicate these findings in a sample of individuals with CUD. The current project recruited 21 regular cannabis users with moderate or severe CUD aged 18-50 years old. Participants viewed pleasant, unpleasant, neutral, and cannabis-related pictures with concurrent EEG recording and completed the cannabis version of the probabilistic choice task. The LPP difference wave for cannabis and pleasant pictures, along with behavioral insight, were used to predict the number of times participants chose to view each picture type. Results showed no effect of the LPP difference waves ($F(1,68)=0$, $p=.987$), behavioral insight ($F(1,68)=1.51$, $p=.223$), or their interaction ($F(1,68)=.03$, $p=.861$) on picture choice. This suggests that differences between cannabis and alternative-reinforcer neurophysiological cue reactivity may not drive behavioral choice, though the analyses will be re-run when the recruitment of the full study sample (~40 individuals) is complete.

Title: Role of sleep in auto-immune diseases

Primary Author: Natasha Wendy Grabau

Additional Authors: Daniel Kroeger;Amol Suryawanshi;Henry Limbo;Julia Peterson;Jiayi Ren;Ferrin Antony;Danielle Forbus;Vander LeKites;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Recent discoveries suggest sleep is essential for the maintenance and optimal functioning of the immune system. We hypothesized that manipulation of sleep via stimulation of sleep active neurons of the Ventral Medial Midbrain/Pons (VMP), a brain center known for its modulating role in sleep in mice, can affect immune responses. In other words, we sought to determine whether increased sleep or decreased sleep could affect how the body responds to infections. For this, we used a mouse model for MS called Experimental Autoimmune Encephalomyelitis (EAE) in which the symptoms and pathophysiology of MS are recapitulated. The model works by temporarily opening the blood brain barrier and immunizing the system with myelin peptides. We then employed chemogenetic activation of sleep-active neurons in the VMP region, by specifically stimulating neurons using the inhibitory neurotransmitter GABA to increase sleep for 4 hours daily in the first of the three groups of mice (n=4). Mice in the second group (n=3) were left to sleep normally, while the third group (n=3) were sleep deprived for 4 hours each day. Neurological symptoms of MS progression were scored daily at dark onset according to an EAE clinical severity scale. When mice reached severity score of 4 (complete hind limb paralysis), the study was terminated and the draining lymph nodes (DLN) and spleen were collected to analyze the percentages and numbers of CD45, CD4, CD8, Treg, Th1 and Th17 using flow cytometry. Our data thus far shows a trend indicating that mice with sleep deprivation may have more inflammatory Th1 cells in the DLN and conversely, less anti-inflammatory Treg cells when compared to mice with normal sleep. This was also reflected in the EAE score of clinical symptoms where sleep deprived mice exhibited more severe scores than mice in the normal sleep group. Interestingly, mice that received extra sleep also displayed more severe clinical symptoms with higher EAE scores.

Title: Designing a powerful bispecific fusion protein for PD1/PD-L1 blockade and OX40 agonism

Primary Author: Nathan Newman

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

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: The difficulty of providing effective treatment for cancer makes it a leading cause of death in the United States. Immune checkpoint inhibitors have revolutionized the treatment of human cancer patients. Immune checkpoint receptors, such as the PD1/PD-L1, prevent overactivation of the immune system to avoid damage to healthy body cells. However, cancer cells overexpress the PD-L1 receptor, thus hijacking the PD-1/PD-L1 pathway to prevent destruction by CD8 T lymphocytes. Immune checkpoint blockade therapy using antagonistic mAbs targeting PD-1/PD-L1 receptors can overcome this tumor cell-mediated immunosuppression. However, only 15-20%%20of human cancer patients respond to PD-1/PD-L1 monotherapies. The therapeutic efficacy of the PD-1/PD-L1 mAbs can be enhanced by combination immunotherapy with an OX40 agonist. When activated, OX40 signaling promotes activation and survival of CD4 and CD8 T cells. This project aims to find an efficient version of the aPD1-Fc-OX40L molecule, which elicits a potent PD-1/PD-L1 blockade and causes OX40 activation. To achieve this, we synthesized, cloned, and expressed six versions of aPD1-Fc-OX40L protein that contain different clones of anti-PD1 nanobodies. We also synthesized, cloned, and expressed seven versions of aPD-L1-Fc-OX40L protein containing different clones of anti-PD-L1 nanobodies. The recombinant plasmids containing various aPD1-Fc-OX40L or aPD-L1-Fc-OX40L DNA sequences were used to construct Expi293F-based stable cell lines to purify recombinant proteins. The recombinant proteins were purified with affinity chromatography using the HiTrap Protein G column. Flow cytometry was run to test the binding of aPD-1/aPD-L1 and OX40L to their respective receptors on hPD-1/hPD-L1 and OX40 effector cells. In future studies, we will purify the remaining aPD1-Fc-OX40L and aPD-L1-Fc-Ox40L proteins. We will compare the ability of these various bispecific proteins to block the PD-1/PD-L1 pathway in a PD1/PD-L1 blockade Bioassay.

Title: Simplifying protein structure prediction using an intuitive educational tool

Primary Author: Nathaniel Hughes

Additional Authors:

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: While many programs exist that can predict protein three-dimensional (3D) structures, not many show the process live or are very interactable. To fill in this gap, GoFold is a new real-time protein folding program and educational tool, which enables users of varying skill levels and backgrounds to manipulate and visualize protein structures in two- and three-dimensions. With three modes of play, GoFold is capable of target and template matching using either 3D structures or 2D distance maps, as well as visualization of proteins by their residues and bonds in 3D space, providing multiple variants of visualization of protein structures. GoFold also holds the capability of calculating the contact map overlap (CMO) score between two protein contact maps by utilizing a double dynamic programming approach. Over multiple datasets, GoFold statistically significantly outperforms the state-of-the-art method, map_align, in predicting high-quality target-template contact maps alignments. GoFold also has minimal dependencies and an easy installation process, making it an accessible tool for researchers and educators.

Title: Pseudogenes and host specificity in a bacterial plant pathogen

Primary Author: Navdeep Kaur

Additional Authors: Leonardo De La Fuente;Neha Potnis;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: *Xylella fastidiosa (Xf)* is a bacterial plant pathogen that infects a wide range of economically important crops. *Xf* strains vary in their host specificity, but the molecular mechanism behind this is unclear. Pseudogenes in bacteria, which resemble genes structurally but do not code for any protein, represent vestiges of functions no longer needed for fitness. Interestingly, pseudogenes in a bacterial human pathogen were hypothesized to be a hallmark of host specialists, as a sign of genome reduction for niche adaptation. The objective of this study was to identify pseudogenes in different *Xf* strains and relate their abundance with potential host specialist/generalist phenotypes. Using Pseudofinder, we analyzed pseudogenes on five different subspecies of *Xf*, i.e., subsp. *fastidiosa*, *multiplex*, *pauca*, *sandyi* and *morus*. Results indicate that subsp. *sandyi* has the highest percentage of pseudogenes followed by subsp. *morus* and *pauca*, while subsp. *fastidiosa* and *multiplex* had the lowest percentages. Strains from the first three subspecies are known to have a narrower host range compared to the last two, therefore our observation aligns with the hypothesis mentioned above. We then focused on strains known to infect blueberries either symptomatically or asymptomatically. We hypothesize that genes pseudogenized only in asymptomatic strains may be important for symptom development in symptomatic strains. Using this criterion, five sequences were identified that were shared among all blueberry-infecting strains. One was a hypothetical protein, and two of them included small intergenic regions and sequences annotated as ‘lepA’ and ‘GGDEF-domain’. The fourth sequence landed in an intergenic region, and a small portion of the fifth sequence was in the ‘parC’ gene. Future work will include mutational analysis of the selected genes and phenotypic characterization in vitro and in planta. Our studies aim to elucidate the basis of host specificity in this devastating plant pathogen.

Title: Valorization of Abattoir Wastes into Value-added Bioproduct Using Black Soldier Fly Larvae Cultivation

Primary Author: Navid Farahmandzad

Additional Authors: Dianna Bourassa;Brendan Higgins;Saravanan Ramiah Shanmugam;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: In the Southeastern U.S., poultry farming and processing is one of the major industry. Abattoir processing generates large quantities of wastewater that is rich in proteins and lipids (fats). Dissolved air floatation (DAF) process is commonly employed to separate the fatty wastes along with other suspended solids. The resulting DAF sludge contains very high moisture content and is currently disposed of as a waste. The present work aims to upcycle the nutrients present in the DAF sludge using black soldier fly larvae (BSFL) bioconversion. Food waste from our campus dining facility "The Edge" at Auburn was mixed with the DAF solids at different mixing ratios – 100:0, 25:75: 50:50, 25:75 and 0:100. Seven-day old BSFL was then added to this organic waste stream and the weight loss was monitored over a period of 10 days. Mixing food waste and DAF solids in a 1:1 ratio showed higher substrate reduction (83 %), biomass yield (36.7 %), biomass gain (5883 %) and bioconversion efficiency (28.1 %) compared to 100 % DAF solids. Nutrient composition analysis showed that BSFL fed food waste and DAF solids at a ratio of 1:1, showed similar levels of crude protein (41.6 %) and lipids (41.5 %). Mineral composition analysis using Inductively coupled plasma - optical emission spectrometry (ICP-OES) revealed that BSFL reared on abattoir and food wastes contains metal ions that are well within the maximum tolerance levels in poultry feeds. These results suggest that BSFL reared on abattoir waste can be formulated as poultry feed. Upcycling nutrients from abattoir wastes into value-added bioproduct such as BSFL cultivation could generate additional revenue to the poultry processors across the state and has the potential to achieve a "Circular Economy" within the poultry industry.

Title: Evaluation of a novel insect-derived feed ingredient on the growth performance and meat yield of broiler chickens

Primary Author: Nelsa Beckman

Additional Authors: Samuel Rochell;Amit Morey;Sungeun Cho;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: The poultry industry is always striving to become more sustainable while maintaining high performance standards. This can be done by altering the feed ingredients that are used. Insect meals are an emerging feed ingredient popular for its sustainability potential as it has very little market competition and requires minimal arable land. Little is known about the effects of feeding black soldier fly larvae frass (BSFLF), therefore, the objective of this study was to determine growth performance and processing yields of broilers fed the frass. Four treatments consisted of a common corn/soybean meal diet as a control and either 5, 10, or 15 percent inclusion of BSFLF. At hatch, 1,200 male broilers (Cobb 500, initial BW 40.0 g) were used in a 41-day study to determine feed intake (FI), body weight gain (BWG), feed conversion ratio (FCR), and processing yields of carcass parts. There were 12 pens per treatment with 25 birds per pen. Pen weight and feed intake were measured on days 0, 13, 28, and 41 to calculate FCR. Twelve birds per pen were randomly selected at the end of the study to be used for determination of chilled carcass and parts weights and yields . Data were analyzed by ANOVA with linear and quadratic contrast statements as well as post-hoc Tukey's means separation in SAS v 9.4 (Cary, NC) . Feed intake was not significantly influenced by frass inclusion in the overall trial period. However, as dietary BSFLF inclusion was increased there was a negative, linear ($P < 0.05$) response in BWG and consequentially impaired FCR. Similar to growth performance, there was also a linear ($P < 0.05$) decline in hot carcass, breast fillets, total white meat, thigh, wing, and drumstick weights as well as breast and drumstick yield as BSFLF inclusion was increased. There were no significant differences in fat pad, total white meat, thigh, or wing yield . In conclusion, feeding increasing levels of BSFLF to broiler chickens negatively impacts both growth performance and meat yield.

Title: Modeling Specialty Crop based (Tomatoes and Strawberries) Agrivoltaic System Profit from Arizona and Alabama

Primary Author: Ngbede Musa

Additional Authors: Ruiqing Miao;Bijesh Mishra;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Agrivoltaics systems, which integrate photovoltaic (PV) panels with agricultural production, offer a promising approach to optimize land use by simultaneously generating renewable energy and cultivating crops. The study evaluates the profitability of high-value crops, specifically tomatoes and Strawberries, within agrivoltaics systems located in Arizona and Alabama. Given the distinct climatic conditions of the two states, this research investigates how regional differences affect crop yield, energy production, and overall system efficiency. Using simulation models, the study assesses crop growth under varying levels of solar panel shading, which alters microclimatic conditions such as light intensity, temperature, and soil moisture. The research further examines agricultural operations alongside revenue from both crop sales and electricity generation. Preliminary results indicate that agrivoltaics systems can enhance the microclimate for crop growth, leading to higher yields of tomatoes and Strawberries in both Arizona and Alabama compared to traditional agriculture. Additionally, the dual-use system promotes water conservation and reduces the carbon footprint of agricultural production. The findings hold significant implications for farmers, energy producers, and policymakers interested in sustainable development, renewable energy, and food security.

Title: Investigation into the Optimization of Air-Cooled Battery Thermal Management Systems for Electric Vehicles

Primary Author: Nicholas Bensman

Additional Authors: Mehmet Arik;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: The demand for electric vehicles (EVs) has increased by 350%%20between 2020 and 2022, according to Consumer Reports. The rise in demand for EVs calls for an increase in the production of more reliable and durable batteries to power them. The most common type of battery cell found in EVs are lithium-ion cells, which offer superior energy density but are known to be susceptible to temperature variations. Automotive manufacturers use battery thermal management systems (BTMSs) to ensure that battery cells stay within their optimal 15-40 C temperature range. The most common BTMSs are air-cooled systems that work by running air through the battery packs to dissipate the heat generated within them. This research was aimed at identifying the optimal configuration of lithium-ion cells within an air-cooled system. Six layout variations were built and tested in both simulation and experimental models. The six models were first computed in the simulation software ANSYS Icepak. In the simulation, the heat generation rates were 3 W and 120 W. The simulation results showed an average layout battery cell temperature of 21.96 C for the 3 W heat generation and 103.46 C for the 120 W heat generation. The most effective layout was the rectangular configuration with a mean cell temperature of 21.91 C and 98.97 C, demonstrating a 0.205%%20and a 4.34%%20difference compared to the average. The results from this simulation will be compared to the experimental results for further validation once battery housing specifications have been matched and built. The decrease in average cell temperature of the rectangular layout seen from the simulation shows the potential for improving the health and lifespan of lithium-ion cells in the large-scale manufacturing of electric vehicle battery packs.

Title: Effect of two acute exercise modalities on physiology and cognition of males and females during firefighter occupational tasks

Primary Author: Nicholas Bordonie

Additional Authors:

Department/Program: School of Kinesiology

College: College of Education

Abstract: Daily exercise is key to optimizing firefighter performance. However, balancing optimal exercise volume with fatigue is difficult due to challenging firefighter shift schedules. Also important to consider are the physiological differences among the firefighter population. Therefore, the aim of this study was to explore the effects of resistance and aerobic training on the ability to complete physical and cognitive assessments after exercise in males and females. 32 volunteers (M/F: 17/15; 25.19 /- 4.12 yrs; 173.78 /- 9.84 cm; 75.57 /- 13.22 kg; 23.28 /- 7.43% body fat) completed 2 pre-testing visits to assess fitness and cognitive performance, followed by 3 sessions of acute exercise in semi-randomized order: resistance exercise, aerobic high intensity interval training, and rested control. Trials were followed by simulated firefighting tasks (SFT), where participants entered an environmental chamber set to 35C/50% humidity to complete 4 rounds of (10 deadlifts (85 or 135lbs) followed by a 0.15 mile, 40lb-sandbag carry). Participants completed the Wisconsin Card Sorting Task (WCST) after the second round, prior to completing the final 2 rounds. RM-ANOVAs were used to compare differences by condition. Average heart rate and core temperature were significantly different between conditions ($p < 0.01$). An interaction between sex and condition revealed that skin temperature average ($p < 0.01$), time to complete SFT ($p < 0.01$), immediate post blood lactate concentration ($p < 0.01$), and average reaction time during the WCST were significantly different ($p = 0.04$) between sexes for all conditions. Findings suggest biological sex influences physiological and cognitive responses during exercise in extreme environments. Further research is needed to investigate variations in physiological responses to extreme conditions in all sexes and races with the goal of safely increasing the diversity of the national firefighter force.

Title: Novel LXR inverse agonists regulate specific cofactor recruitment in diabetes and NAFLD

Primary Author: Nicholas Crall

Additional Authors: Rajesh Amin;Meenakshi Singh;Fajar Setyo Wibowo;Ian Steinke;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: The Liver X receptor (LXR) is a nuclear transcription factor that regulates the transport and metabolism of lipids and cholesterol as HDL. Oxysterols, metabolites of cholesterol, are centrally located in the paradigm of APOE dysregulation and cholesterol balance towards type two Diabetes Mellitus (DM) and NAFLD pathology. LXR agonists induce steatosis and neutropenia in humans and thus have failed at the clinical level for atherosclerosis. LXR exists as two isoforms, LXRα, expressed highest in the liver, macrophages, lungs, and kidneys, while LXRβ is more abundant in the brain. We hypothesize that inverse agonists for LXRα demonstrate a safer ADME profile, decreasing side effects while improving cholesterol modulation towards diabetes and NAFLD pathology. Schrodinger suite, bioluminate, was used to perform protein-protein docking studies. A support vector machine (SVM) algorithm validated the cofactor docking site. Molecular dynamic (MD) simulations in Schrodinger studied the stability of cofactors in the binding site when influenced by various ligands. Our preliminary data in-silico has determined that our novel compounds serve as LXR inverse agonists to influence cofactor recruitment and stability of helix-12 compared to control compounds. Last, we have observed a significant bias toward LXRβ, showing compounds developed are viable in diabetes while avoiding steatosis, neutropenia, and atherosclerosis. Our novel compound forms interactions with LXRα at residue Arg305 while avoiding the AF-2 ligand-binding domain, resulting in a conformational shift. This shift induced by our novel compounds allows for alternative gene expression compared to full agonists and avoids unwanted toxicity. Future work will focus on luciferase assays to develop derivative compounds for the region next to the AF-2 to mediate transcription and cofactor recruitment.

Title: Pharmacological Applications of Thuja occidentalis and its Therapeutic Effects.

Primary Author: Nicholas Martin

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Thuja occidentalis, the tree of life, or more commonly known as, American cedar and white eastern cedar is grown mainly in European regions and is used as a medicinal plant on account of its therapeutic administration. It belongs to the Cupressaceae family and is also referred as Thuier cedar. Thuja occidentalis exhibits pharmacological effects through its coumarins, flavonoids, and many essential oils. These effects include: anti-inflammatory, antioxidant, antifungal, antibacterial, gastroprotective, antiviral, antipyretic, and anticarcinogenic activity. Thuja also carries protective effects against toxicity induced from radiation and regulates glucose and lipid metabolism. This allows Thuja to be used as a treatment or preventative measure for various human pathologies.

Title: Differences in throwing phase durations between fast and slow transfer times in youth baseball catchers

Primary Author: Nicholas Mauldin

Additional Authors: Gretchen Oliver;Nicole Bordelon;Billy Lozowski;Benjamin Lerch;Ryan Zappa;Adam Nebel;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Transfer time in baseball catching is the duration from receiving a pitch until the ball is released for a throw to second base. This study aimed to compare the duration of throwing phases between fast and slow transfer times in youth baseball catchers. Kinematics of 21 youth catchers (12 +/- 3yrs, 52.7 +/- 14.8kg, 1.57 +/- 0.15m) were recorded and analyzed using an electromagnetic motion capture system (100Hz). Transfer time consisted of three phases: Start phase (movement initiation to stride foot contact), arm-cocking phase (stride foot contact to maximum shoulder external rotation), and acceleration phase (maximum shoulder external rotation to ball release). Two repeated measures MANOVAs were used for within-subjection comparison for each participant's fastest and slowest trials. The first analysis (TT) compared the total time spent in each phase of the event, while the second analysis (PT) examined the percentage of time spent in each phase of the event. Significant within-subjects differences were observed for fast and slow trials in the TT analysis ($F_{(3,18)} = 6.20$, $p = .004$). Follow-up univariate analysis for TT showed the start phase being significantly quicker ($F_1 = 15.33$, $p < .001$) for fast trials (0.77 + /- 0.24s) compared to slow trials (1.17 +/- 0.49s). The remaining phases presented no differences in the TT analysis ($p > .514$). The PT analysis revealed significant differences between the fast and slow trials ($F_{(2,19)} = 9.80$, $p = .001$). Follow-up univariate analysis for the PT test revealed that in the fast trials, the start phase was significantly shorter (75.9 +/- 7.7 vs 81.9 +/- 6.9%; $F_1 = 12.23$, $p = .002$), whereas the arm-cocking (18.63 +/- 6.4 vs 14.35 +/- 5.5%; $F_1 = 8.95$, $p = .007$) and acceleration phases (5.5 +/- 2.2 vs 4.2 +/- 2.0%; $F_1 = 19.82$, $p < .001$) were longer. These results suggest that to maximize performance a catcher should focus on decreasing the time spent in the start phase.

Title: Factors influencing provision of COVID-19 diagnostic testing services in retail and non-retail Alabama pharmacies.

Primary Author: Nicholas McCormick

Additional Authors: Salisa Westrick;Spencer Durham;Christopher Meininger;Oluchukwu Maureen Ezeala;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: This cross-sectional study aims to identify factors associated with offering COVID-19 diagnostic testing in Alabama pharmacies. Of 1,172 Alabama pharmacies, a final 240 participants completed a self-administered paper and online survey in February–April 2023 (RR=20.5%). Exploratory Factor Analysis (EFA) was conducted on a Pharmacist Perceived COVID-19 Diagnostic Testing Barriers (PDT-B) measure, utilizing an ML extraction method, and excluding items with loadings <0.400. The PDT-B yields three components: Fear of Exposure, Organizational Logistics, and Administration Logistics, each with adequate internal consistency ($\alpha > .600$). Bivariate analyses unveil significant associations between COVID-19 diagnostic testing provider status and characteristic factors such as race ($p \leq .05$), pharmacy type/setting ($p \leq .001$), and prescription dispensation volume ($p \leq .001$), alongside components of the PDT-B, Organizational Logistics ($p \leq .01$) and Administration Logistics ($p \leq .001$). Multivariable logistic regression model utilizing statistically significant variables elucidate that retail pharmacies ($p < .001$) and those with lower Organizational Logistics ($p = .015$) barriers increased the likelihood of offering testing. Further bivariate analyses between retail and non-retail pharmacies and subsequent multivariable logistic regression models utilizing PDT-B item-level responses described lower levels of perceived barriers related to “personal exposure to the virus” in retail pharmacies ($p = .047$), and “meeting testing regulations/requirements” in non-retail settings ($p = .025$), as associated with the increased likelihood providing testing services. These findings describe the factors shaping pharmacies' decisions to provide critical COVID-19 diagnostic testing services, underscoring the need to address specific barriers and tailor interventions across pharmacy settings.

Title: Evaluation of Anti-hyperglycemic and Sexual Stimulatory Pharmacodynamic Actions of Ayurvedic Natural Bioactive

Primary Author: Nicolas Ochoa

Additional Authors: Courtney Alexander;Muralikrishnan Dhanasekaran;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Central and peripheral dopaminergic neurotransmission plays a vital role in the maintenance of several physiological functions in humans. Erectile dysfunction can occur due to decreased dopaminergic neurotransmission and hyperglycemia. Thus, pharmacological strategies to increase dopaminergic neurotransmission and decrease hyperglycemia can be a novel therapeutic approach to improve erectile dysfunction and overall well-being in men. *Mucuna pruriens*, a prominent Ayurvedic herb, possesses levodopa (dopamine precursor) and other natural bioactives, which can considerably enhance dopaminergic neurotransmission. Novel strategies augmenting the dopaminergic neurotransmission can be used to treat various central and peripheral disease states. Our previous studies have clearly validated the pharmacological activity of *Mucuna pruriens* (increased dopaminergic neurotransmission, neuroprotection, anti-Parkinson's effect, antioxidant & metal chelating action). The existing hypothesis depicts that decreased dopaminergic neurotransmission and hyperglycemia lead to erectile dysfunction. Hence, the primary objective of this study was to establish the hypoglycemic action and sexual stimulatory effects of *Mucuna pruriens* in rodents. The secondary objective was to evaluate the effect on general rodent behavior, which can validate the safety profile of *Mucuna pruriens* for clinical use. Based on the existing literature and the current hypothesis, the current study evaluated the effect of *Mucuna pruriens* on blood glucose and male sexual activity in rodents. *Mucuna pruriens* significantly decreased blood glucose levels and increased male sexual activity and behaviors in rodents (mount frequency and latency, intromission frequency, and ejaculation frequency). Thus, *Mucuna pruriens* can be the alternative natural bioactive to prevent and treat sexual dysfunction.

Title: Evaluation of the immunoregulatory effects of mesenchymal stromal cell derived extracellular vesicles on feline mixed glia

Primary Author: Nikolia Darzenta

Additional Authors:

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Mesenchymal Stromal Cells exhibit immunoregulatory properties in vitro and in vivo due to the bioactive effect of their secretome. They release Extracellular Vesicles (MSC-EVs), which are a heterogenous population of double layer membrane carriers enriched with parental cell-derived cargos that contribute to cellular communication. Stem cell EVs can alleviate neuroinflammation via suppression of astrogliosis and microgliosis and cross the brain blood barrier, making them a promising tool against CNS pathology. Sandhoff disease (SD) is a GM2 Lysosomal Storage Disease, caused by N-acetyl-β-hexosaminidase mutations. It is characterized by progressive, rapid, and fatal neurodegeneration and typical neuroinflammatory features, such as astrogliosis and microgliosis. Our objective is to study the immunosuppressive properties of MSC-EVs on mixed glia, the main brain immune cells, from SD cats and compare them to those from normal cats. Isolated mixed glia from feline brain tissue were phenotypically characterized via flow cytometry and immunofluorescence. 108 primed and non-primed isolates of umbilical cord MSC-EV were characterized and added to naive and LPS-stimulated cells to assess their immunoregulatory effect after 24 and 48 hours. Cell culture supernatants were collected to measure the production of the pro-inflammatory cytokines (IL-6) through ELISA. mRNA expression of main inflammatory mediators (NF-κB) was assessed via RTqPCR. Isolated feline mixed glia express microglial (CD11b/CD45R) and astrocytic (GFAP) markers. Neurons (anti-NeuN) and endothelial cells (PDGFRb) were present too. Our preliminary data indicate that MSCs–EVs decrease the production pro-inflammatory cytokines in mixed glia from SD and normal cats. In conclusion, our findings support the use of MSC-EVs as a promising therapeutic against SD neuroinflammation in vitro. Our future goal is to study the immunoregulatory effects of MSC-EVs in the SD feline in vivo model.

Title: Forest aboveground biomass estimation using airborne lidar: a systematic review and meta-analysis

Primary Author: Nisham Thapa

Additional Authors: Lana Narine;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Forest aboveground biomass (AGB) estimation is a research area crucial not only for understanding carbon dynamics but also for supporting policy-related activities like reducing emissions from deforestation and forest degradation (REDD) program and the Paris Agreement. The availability of open-access airborne lidar data has fueled research in developing sophisticated methods for AGB estimation. However, a comprehensive synopsis of milestones achieved in AGB estimation using airborne lidar is still lacking. This study fills this gap by exploring methods and associated challenges with AGB estimation using airborne lidar. The overall objective of the study is to conduct a meta-analysis of peer-reviewed journal articles on AGB estimation using airborne lidar, published after the year 2010. The specific objectives are to: 1) evaluate methods for estimating AGB using airborne lidar data for different forest types, and 2) compare AGB model performance of airborne lidar-based models and models using airborne lidar in fusion with multi-sensor data. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework to select articles from over 600 journal articles focusing on AGB and airborne lidar. We aim to show a systematic assessment of AGB estimation accuracy between different methods used in the past decade for different forest types. The findings will provide new insights to researchers in understanding the trends in methods used and highlight recommendations for advancing the state of the art in AGB estimation accuracy using airborne lidar.

Title: A comparative investigation of bio-lubricants synthesized via esterification, epoxidation, and Friedel-Crafts reaction using oleic acid as feedstocks

Primary Author: NOOR FATIMA

Additional Authors: Brendan Higgins;Robert Jackson;Sushil Adhikari;Hossein Jahromi;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Bio-lubricants have become more prominent in the automotive sector as a substitute for conventional petroleum-based lubricants. However, the existing bio-lubricants fail to meet all specifications required to produce efficient base oils for fully formulated engine oils. This is mainly due to insufficient knowledge on the influence of molecular architecture/structure on flow properties of bio-lubricants. The main objective of this study was to investigate the effect of molecular size and structure on lubricant properties. We performed a comparative study between three procedures for producing bio-lubricants: conventional esterification and epoxidation, as well as a newly developed three-step method. The new method involved the conversion of oleic acid to oleoyl chloride, followed by dehydration to produce oleic anhydride, followed by Friedel-Crafts (FC) acylation of the anhydride with anisole. A variety of analytical tests were conducted, including Fourier Transform Infrared Spectroscopy (FTIR), flash point, viscosity, pour point, viscosity index (VI), and Differential Scanning Calorimetry (DSC). The esterification process was conducted using a mixture of oleic acid and different alcohols including methanol, ethanol, isopropanol, and cyclopentanol. The epoxidation reaction was performed with the use of hydrogen peroxide and acetic acid as oxidizing agents. The FC method was employed to chemically modify the oleic acid structure to produce a molecule that consisted of a linear chain attached to a naphthenic ring. The esterification of oleic acid with methanol yielded a bio-lubricant with the viscosity index of 288.0 and a kinematic viscosity (at 40℃) (KV40) of 12.7 to centipoise (cP), while the analysis of other bio-lubricants are in progress at the time of this submission. The FC method exhibited a viscosity index of 177.3 and a KV40 of approximately 57.5 centipoise (cP). It is expected that the bio-lubricants with linear and ring structure possess improved properties based on a previously published article.

Title: Injectable capsaicin in situ forming implant for ultra-long-acting antiobesity: Characterization, drug release, stability, and cytotoxicity studies

Primary Author: Nur Mita

Additional Authors: Jayachandra Ramapuram;Oladiran Fasina;Chu Zhang;Xuejia Kang;Ishwor Poudel;Manjusha Annaji;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Capsaicin, a TRPV-1 receptor agonist, is an antiobesity agent that enhances metabolism, energy expenditure, and thermogenesis to counter high-fat diet-induced obesity. However, its low solubility in an aqueous environment, short half-life and bioavailability, and oral pungency hampered capsaicin's clinical development. In-situ forming implants (ISFI), a long-acting injectable delivery system, can overcome those problems. The research aimed to develop capsaicin-ISFI for obesity treatment. The ISFIs were developed by dispersing capsaicin into PLGA solution, with different liquid lipids as the drug release retarders, then characterized for their visual appearances, viscosities, and solidifying times. *In vitro* release study was carried out using the 'Sample and Separate' method, where the samples were collected for up to 5 months. The initial burst release and kinetics models were compared, and the selected formulation was characterized by its morphological features and thermal analysis. The injectability parameters in various syringe and needle dimensions were predicted based on the ISFI rheological behavior. A stability study was performed for 6 months at room temperature. The cytotoxicity studies were done using Alamar blue viability assay and AM-PI staining in mouse fibroblast L929 cell lines. The result showed that CM75 was the selected formulation with the specification of transparent yellowish color, has spontaneous solidifying time, a viscosity of 134.97 /- 0.12 mPa.s at 20 rpm, and follows Newtonian fluid behavior. The predicted injection forces in 19 – 30 Gauges were within the acceptable values. Capsaicin was sustained released from ISFI entirely in 5 months following the Korsmeyer-Peppas model with a minimum initial burst release of 7.97 /- 1.29 %. The assay showed a stable ISFI formulation with a recovery of 96.35 /- 0.58%. The cytotoxicity results showed /- 100%%20viability, indicating that the system is potentially biocompatible for a subcutaneous route.

Title: Standardizing success: Creating gait and behavioral markers of prognosis in feline models of neurodegenerative diseases.

Primary Author: Olivia Grigsby

Additional Authors: Emily Graff;Douglas Martin;Jordan Doss;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: The brains of humans and domestic cats are similar, with extensive gyrification and complex development of the cerebral cortex. This makes the domestic cat an excellent model of neurodevelopmental and neurodegenerative diseases that manifest in various clinical signs, with gait ataxia (motor coordination) and behavioral abnormalities (cognitive function) being common. Similar to humans, cats have inherited disorders that result in neurodegenerative GM1 and GM2 gangliosidosis, and cats are an important translational model for ongoing human gene therapy clinical trials. The aim of this study is to assess changes in gait and memory in domestic cats and translate them into measurable markers of disease progression and response to therapy. To establish a normal reference, gait analysis, including front and rear stride, right and left crossover, and front and rear base, was measured in healthy kittens at 1, 2, 4, 6, and 12 months into adulthood. These findings were compared to age-matched GM1 and GM2 kittens that were untreated or treated with gene therapy. Repeated measures (ANOVA) and T-tests were performed to evaluate the effects of development and differences between treatment groups. During development, front and rear stride length significantly increased by 4 months, and rear base width stabilized by 3 months of age. There were no developmental effects on crossovers, which highlights the early development of proprioception. Additional gait analysis and behavioral testing, including novel object and T-maze testing to evaluate memory and learning, will be completed in normal, GM1 and GM2 untreated, and gene therapy-treated cats to determine response to therapy. We hypothesize that untreated cats with neurodegenerative diseases will have reduced recognition memory and that treatments will reduce or reverse this effect. Results from these studies will help establish a therapeutic index for motor coordination and cognitive function that can be applied to human clinical trials.

Title: Exploring the role of personality in the association between maladaptive social media use and internalizing symptoms

Primary Author: Olivia New

Additional Authors: Diana Samek;Brianna Crumly;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Increases in social media use (SMU) and mental health symptoms have prompted some to propose a causal link. Yet, research has yielded generally small effects and inconsistent interpretations which may be indicative that other factors account for the relationship between SMU and mental health. Investigating internalizing symptoms, we explored if trait negative affect might be one such factor to help explain these inconsistencies. Using a developmental psychopathology framework, we investigated if possessing higher levels of negative affect may account for the association between an individual's SMU and internalizing symptoms. Data was from two samples of diverse, first-year college students (Cohort 1 N = 191, 69%%20BIPOC, 52%%20female; Cohort 2 N = 195, 81%%20BIPOC, 53%%20female). Similar methods were used to collect data from both cohorts. Three SMU scales were utilized. Study 1 assessed addictive SMU; Study 2 assessed disordered SMU and intensity of SMU. Negative affect was assessed using the Personality Inventory for the Diagnostic and Statistical Manual of Mental Disorders. Internalizing symptoms were assessed using well-validated depression, anxiety, and somatic symptom scales. Each SMU variable was significantly associated with internalizing symptoms, as was negative affect. There were significant indirect effects of negative affect linking each SMU variable to the latent internalizing symptoms variable. Direct effects of SMU on internalizing lost statistical significance when including indirect effects through negative affect. Results generally support a developmental psychopathology framework, wherein individual differences in trait constructs help account for inconsistent findings. Current study strengths include using multiple racial/ethnic and gender diverse samples and three SMU measures. The main limitation was that data was cross-sectional; longitudinal data collection is currently underway in our lab. Replication and extension of this work is needed.

Title: Factors associated with the implementation of pediatric immunization services: a survey of community pharmacies in Alabama

Primary Author: Oluchukwu Maureen Ezeala

Additional Authors: Salisa Westrick;Spencer Durham;Christopher Meininger;Nick McCormick;

Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: The COVID-19 pandemic caused a decrease in pediatric immunization (PI) rates in Alabama and across the United States. To address this, pharmacists' role in PI was increased under the PREP Act until December 2024, overriding the pre-existing laws throughout the 50 states. This study aims to: describe the types of pediatric vaccines offered at community pharmacies; compare pharmacists'/pharmacy characteristics, and pharmacists' perceptions of barriers and roles between PI providers and non-providers; and assess factors associated with pediatric immunization offering. A self-administered paper and online cross-sectional survey were sent to the 1172 community pharmacies in Alabama from February – April 2023. Measures included whether the pharmacies provided recommended vaccines to children 10 or younger in 2022 and the types of vaccines offered (response options: yes/no); pharmacists' perceptions of their roles in PI (response options: strongly agree (1) to strongly disagree (4)), and perceived barriers to offering PI (response options: not a barrier (1) to a major barrier (4)). The response rate was 20.5% (240 pharmacies responded). Only 50.8% of surveyed pharmacies provided PI services. Influenza vaccines (91.0%) was offered most and poliovirus inactivated vaccines (4.9%) the least. PI providers significantly differed from non-providers in pharmacist age, pharmacy type/setting, average daily prescription volume, average pharmacy practice full-time equivalents, implementation logistics barrier, and pharmacists' perceived role. The multivariable logistic regression analysis showed that implementation logistics barrier ($p = 0.01$) is significantly associated with pediatric immunization offering by pharmacies, after controlling for pharmacy and pharmacists' characteristics. As such, implementation logistics barrier is the most important variable to consider when developing interventions to encourage pediatric immunization services in community pharmacies.

Title: HEMP MARKET DYNAMICS: ANALYSING THE TREND IN CONSUMER BEHAVIOR AND PERCEPTION OF CBD

Primary Author: Omolola Abisola Bankole

Additional Authors: Adam Rabinowitz;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Hemp has become a popular crop and ingredient for sustainable products, leading to the growth of the hemp-based products market. However, there is little knowledge of consumer behavior toward hemp and hemp-based products. This study highlights the importance of tracking changes in consumer behavior toward hemp-based products by studying trends in the past two years to better inform supply chain decisions hemp production and related processing. This research is a comparative analysis of survey data of US residents in 2021 and 2022 on their awareness and consumption of hemp-based products. Our finding revealed that more than a third of respondents have tried CBD, and approximately 50%%20of CBD consumers are using it either daily or weekly. The results also indicate that once a consumer, consumption is frequent and consistent and that consumers are becoming more comfortable incorporating hemp into their lifestyles. Similarly, more than 25%%20of non-consumers indicated they are likely to try CBD within the next month. Results of this study can provide stakeholders with valuable market information on how consumer attitudes and preferences have changed over a two-year period and the further development of this growing market.

Title: Valorization of bioactive-rich plant wastes: Applications in the aquaculture industry

Primary Author: Omolola Kafi

Additional Authors: Burak Aksoy;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Although water covers more than 70% of the Earth's surface, just 2% of seafood items are produced there to meet global demand. The fish and aquaculture industry attempts to meet this demand, producing over 87.5 million tons of aquatic animals for consumption. In the United States, aquaculture production is valued at USD 1.5 billion, providing both economic value and food. However, there is significant loss at different stages of production. This research aims to valorize bioactive-rich plant wastes as sustainable green alternatives to synthetic chemicals used for aquaculture products. Considerable waste is generated from the processing of fruits and vegetables, accounting for up to 25–30% of the total production. The valorization of these plant wastes is linked to the presence of bioactive compounds (phytochemicals), which provide a sustainable strategy for controlling bacterial activity that causes food waste and the management of plant processing by-products. For preliminary investigations, significant spoilage bacteria isolated from rancid channel catfish fillets were inoculated into growth media modified with varying concentrations of activated lemon pulp. A considerable bacteriostatic effect was observed from complete inhibition to 1.8×10^7 cfu/mL at 0.2% and 0.1% of lemon pulp, respectively ($p < 0.05$). The observed antimicrobial effect of lemon pulp on prominent fish spoilage bacteria was then tested for its effect on the shelf life of fillets using packaging coated with lemon pulp. In the control group, spoilage bacteria exhibited a 5-log increase in growth. Fillets stored with modified lemon pulp-coated packaging presented the lowest bacterial load after 11 days of storage at 4 degrees Celsius, indicating the potential use of lemon pulp as a natural preservative to extend seafood shelf life.

Title: Pathogenic and Non-pathogenic E. coli strains Discrimination in Urine Samples by LC – IM – MS/MS and Machine Learning

Primary Author: Orobola Olajide

Additional Authors: Ahmed Hamid;Jingyi Zheng;Michael Zirpoli;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Determining bacterial identity at the strain level is crucial for public health to enable appropriate medical treatment and reduce antibiotic resistance. Towards this goal, we introduced a rapid discrimination technique, paper spray – ion mobility – tandem mass spectrometry (PS-IM-MS/MS), to rapidly distinguish seven non-pathogenic strains. The rapid detection of these strains was achieved in less than 2 minutes. However, the strains could not be accurately distinguished due to the low predictive power of PS-IM-MS/MS, which was due to limited analytical resolution and matrix effects leading to ionization suppression. Therefore, we coupled liquid chromatography instead of paper spray with ion mobility and tandem MS (LC-IM-MS/MS) to discriminate the seven non-pathogenic E. coli strains using their lipidomic make-up. Tandem MS and LC separation proved to be effective in discriminating diagnostic lipid isomers in negative mode, while IM separation was more effective in resolving lipid conformational biomarkers in positive ion mode. Using this multidimensional analytical separation method (LC-IM-MS/MS), we successfully discriminated the non-pathogenic strains with a high accuracy of 96.1 percent and 100 percent in the negative and positive ion modes, respectively.Next, we investigated the ability of LC-IM-MS/MS to discriminate six non-pathogenic and five pathogenic E. coli strains based on metabolites, lipids and peptides. For each strain, we combined the retention time (LC), drift time (IM), fragment ions (tandem MS) and abundance of these small molecules and used machine learning classifiers to discover unique biomarkers for each strain. We then tested these signatures in unknown urine samples using targeted proteomics and lipidomic. This method enabled accurate and successful bacterial identification in an unknown urine sample.

Title: Pore Structure Characterization in Carbonate-Rich Geologic Samples Utilizing Multi-Scale Computed Tomography, Deep Learning Segmentation, and Reactivity Experiments for Geologic Carbon Sequestration Applications in the Southeastern US.

Primary Author: Otis Williams

Additional Authors: Lauren Beckingham;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: Currently the Southeastern US accounts for over 20% to 25% of total atmospheric CO2 emissions in the United States. Geologic Carbon Sequestration (GCS) has shown promise as a technology to assist in lowering emissions. Once captured, atmospheric CO2 is injected into a deep saline aquifer and begins to react with the formation of brine and present minerals. This can lead to the CO2 being permanently trapped in the form of carbonate rock. Determining the extent and rate of reactions, impacts on geologic properties, and timescale on which CO2 will be mineralized has continually proven to be a major challenge. Previous work has concluded that GCS timescales are highly dependent on the geologic characteristics of the formation, with sandstones and carbonates showing the most promise as storage formation types. The primary focus of this research is GCS applications in carbonate-dominant reservoirs in the Southeastern US. Carbonate minerals react quickly with the CO2-acidificed brine, but the benefits or disadvantages of this are not fully grasped. There is also difficulty in predicting the rate, extent, and impact of reactions on formation properties due to the complex and multi-scale nature of carbonate pore structures. In this research a sample from a potential GCS site in Cassville, Ga is analyzed using a multi-scale 3D X-ray micro computed tomography (CT) imaging approach. These CT images are segmented utilizing a U-net deep learning algorithm to measure and calculate multi-scale porosity, pore connectivity, pore-size distribution, and assessable surface area. This work also includes core-flooding reactivity experiments, and imaging before and after provides insight into the formation's capacity as a GCS site.

Title: Role of type VI secretion system of Xanthomonas perforans in the manipulation of tomato leaf microbiota and environmental cues

Primary Author: Palash Ghosh

Additional Authors: Neha Potnis;Destiny Brokaw;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Type VI secretion system (T6SS) is a contact-dependent secretion system in Gram-negative bacteria that delivers toxins and effectors directly inside the target prokaryotic and eukaryotic cells. T6SS has been proposed to be an important determinant in mediating interactions of pathogenic bacteria with the resident microflora. However, we have little evidence on the importance in T6SS in mediating plant-pathogen-microbiome interactions. Our previous work has indicated hypervirulence phenotype and compromised epiphytic colonization of the T6SS mutant of Xanthomonas perforans, a foliar pathogen causing leaf spot disease on tomato. This finding has led us to hypothesize that T6SS offers epiphytic fitness to the pathogen by offering competitive advantage in presence of resident flora and creating its niche in the phyllosphere. In this study, we have screened a library of phyllosphere bacterial residents for their interaction with X. perforans and for their ability to induce T6SS of X. perforans under in vitro conditions. Our results have identified phyllosphere residents that may interact with X. perforans via activation of T6SS i3*and/or with i3***. A parallel culture-independent approach was also employed to evaluate the influence of T6SS in microbiome manipulation and its response to different abiotic stress and antibiotics. Our findings reveal how Xanthomonas can alter the tomato microbiome and environment during its colonization of leaf surface.

Title: Antimicrobial resistance and antimicrobial residues in the different stages of commercial poultry environment and across the food chain

Primary Author: Pankaj Prakash Gaonkar

Additional Authors: Laura Huber;Ken Macklin;Melissa Boersma;Matthew Bailey;Yagya Adhikari;Courtney Higgins;Reed Golden;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Antimicrobial resistance (AMR) threatens the poultry industry, causing economic losses due to increased mortality rates and higher treatment costs. The objectives of this study were to determine AMR levels in the environment of different stages of commercial poultry farms; to quantify antimicrobial residues present in the same environment; and to determine impact of management practices and antimicrobial residue on AMR. Commercial poultry farms in different stages of production practicing restricted antimicrobial use were included (N=16). Data on farm practices, antimicrobial use (AMU), and samples from litter, soil, and carcass rinses were collected. Frequency of 3 mobile genetic elements (MGE) and 14 antimicrobial resistance genes (ARGs) conferring AMR to 8 antimicrobial classes was assessed using qPCR. Liquid Chromatography-Mass Spectrometry will be used to detect antimicrobial residues. Poultry farms in this study had history of AMU for therapeutic purposes. In broiler farms, frequency of AMR to most antimicrobial classes was higher than breeder and pullet farms. Frequency of sulfonamide ARGs was higher in pullet and breeder farms, while beta-lactam ARGs were more common in breeder farms. AMR to most antimicrobial classes was higher in litter than soil. In processing plant, most ARGs were found only in post-pick stage except that aminoglycoside ARGs were also found in post-chill stage. MGEs were most predominant on broiler farms, litter, and post-chill stage. Additionally, impact of antimicrobial residues and management practices on AMR will be presented. Despite restricted AMU, there is potential for AMR spread across the food chain in commercial poultry. Historic AMU may have resulted in the persistence of antimicrobial residue in environment of farms with restricted AMU. Understanding the impact of historic AMU on AMR and accumulation of antimicrobial residues in the environment will provide potential pathways of AMR transmission across the food chain.

Title: Temptation, Self-Control, and (In)Consistency of Food Choices: An Online Field Experiment

Primary Author: Pathmanathan Sivashankar

Additional Authors: Samir Huseynov;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: We studied whether consumers exhibit dynamic (in)consistency in food choices when presented with different food alternatives or do they exercise self-control in their decisions. We use 137 subjects from a land grant university in the southeastern United States in a 2-day online experiment with seven combinations of food menus. We look at food menu rankings at color and information treatments, measure Global Temptation Index, and finally look at choice reversals of the selected food menus. From the preliminary analysis, we find that subjects prefer G & R (i.e. healthiest and unhealthiest menu) singleton menus compared to other menus. However, we do not find the impact of treatment conditions on food choice reversals. The findings of the study shed further light on why consumers exhibit dynamic (in)consistency.

Title: Educate, innovate, sustain: unraveling industry 5.0's influence on hotels energy management

Primary Author: Patience Ngcobo-Onunkwo

Additional Authors: Imran Rahman;

Department/Program: School of Hospitality Management

College: College of Human Sciences

Abstract: The hotel sector faces energy consumption, environmental impact, and operational cost challenges. To address these, a Smart Sustainable Energy Management System (SSEMS) is needed to optimize energy resource utilization and promote sustainable solutions. Thus, the idea of SSEMS sprang out as a promising concept that seeks to develop advanced technologies that go beyond traditional sustainable practices by exploring the scalability of Industry 5.0 design principles for hotel operations, focusing on improving Energy Efficiency. These designed principles in the context of hotel operations led to the emergence of a Smart Sustainable Energy Management System (SSEMS) 5.0. This new framework aims to improve hotel operations' efficiency by integrating Industry 5.0 design principles, such as AI, IoT, and automation systems using more advanced sustainable strategies. Thus, SSEMS 5.0 technologies can monitor, control, and optimize energy consumption, reducing environmental impact and promoting long-term sustainability. However, the challenges faced by hotels in incorporating Industry 5.0 technologies into their operational workflow, especially in the context of energy consumption and utilization, and the disadvantages of its adoption remain ignored and under-explored. Thus, strategically navigating these challenges can maximize technological integration. The anticipated findings reveal that SSEMS 5.0 Technologies are expected to enhance hotels' energy management, playing a crucial role in addressing skills gaps and promoting sustainable technologies. These findings contribute valuable insights for industry practitioners and practical recommendations for hotel managers and policymakers to foster and apply a more strategic sustainable, and competitive landscape on technology adoption that benefits hotel operations in the hospitality industry.

Title: Impact of benzoic acid supplementation in low-protein diets for starter pigs.

Primary Author: Paulo Henrique Amadeu De Azevedo

Additional Authors: Marko Rudar;Haejin Kim;Alex Outlaw;Abigail Crosby;

Department/Program: Department of Animal Sciences

College: College of Agriculture

Abstract: Utilizing low crude protein (CP) diets presents a potential avenue for reducing both feed costs and nitrogen excretion in swine production. However, dietary non-essential amino acid content must be considered in addition to essential amino acid content in the context of low CP diet formulations. Dietary glycine content may become limiting in such diets because this amino acid in corn and soybean meal is low relative to pig requirements. The objective of this study was to evaluate the effect of adding benzoic acid, which is excreted in urine as its glycine conjugate hippuric acid, to low CP diets on the growth performance of starter pigs. At 28 d age, pigs were weaned and divided into nursery room pens according to body weight and sex (5 mixed-sex pigs per pen). Pigs were fed a commercial nursery diet for 4 d; at 32 d age, pigs were weighed and pens were assigned to one of three dietary treatments: 1) high crude protein (HCP; n = 9 pens); 2) low crude protein (LCP; n = 9 pens) and 3) low crude protein benzoic acid (LCP BA; n = 9 pens). Pigs were fed for four weeks and pig body weights and feed disappearance were measured weekly. Average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (FE; gain-to-feed ratio) were calculated. The ADG of the HCP group was higher than the LCP BA (0.58 vs 0.51 plus-minus 0.01 kg/d; P < 0.05), whereas the LCP group was intermediate (0.54 plus-minus 0.01 kg/d; P > 0.10). There was no difference in ADFI among groups (P > 0.05). However, FE of the LCP BA group was lower than either the HCP group (0.53 vs 0.58 plus-minus 0.01 kg/kg; P < 0.05) and LCP group (0.53 vs 0.57 plus-minus 0.01 kg/kg; P < 0.05) and there was no difference in FE between the HCP and LCP groups (0.58 vs 0.57 plus-minus 0.01 kg/kg; P > 0.05). These findings suggest that the observed reduction in growth performance with benzoic acid exceeds that achieved by feeding low CP diets alone. These findings also caution against supplementing low CP diets without adding additional protein.

Title: Using human pose estimation for control of autonomous systems

Primary Author: Paxton Albright

Additional Authors:

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Human pose estimation is a task in computer vision that uses key landmarks on the human body to identify the pose of a person within an image or video. Previous work has used human pose estimation as an interface for a range of devices, including video games, presentation slide decks, and social robots. However, this modality has not yet been fully explored in the realm of autonomous systems. This research aims to identify predefined poses and assign them to tasks of the autonomous system, allowing for the human body to be used as a controller through the use of artificial intelligence. Software was constructed that extended the range of pose estimation and identified people within the frame; assigning a name to their pose if the predefined conditions were met. Here, I will show the results of distance effects on pose estimation, as well as a comparison of machine learning pose classification, made with Google's Teachable Machine, and classifications from calculated data on a training set of 15 poses at a distance of 20 to 80 feet. Using this method will allow for human interaction with autonomous systems without the need for interfacing devices.

Title: Pitch Perception and Production in Music: A Study Determining the Benefits in Aided versus Unaided Listening.

Primary Author: Bailey Branham

Additional Authors: Bailey Branham;Kathleen Lea;Aurora Weaver;Mary Sandage; Payton Lack

Department/Program: Speech Language and Hearing Sciences

College: College of Liberal Arts

Abstract: This project assessed the benefits of properly fit amplification on pitch perception and production, for musically inclined individuals. Specifically, if hearing aid use significantly enhances: music perception, pitch perception, and singing accuracy (i.e., pitch production).To date, there is limited insight into how hearing aid technology influences musicians' singing accuracy. This case study investigated the benefits of properly fit amplification for a musically inclined individual, specifically, music perception, pitch perception, and singing accuracy (i.e., pitch production) were measured with and without amplification. A single subject design was used to develop a proof-of-concept data. Data was collected on a single male participant, age 23 years, presenting with a bilateral, sensorineural hearing loss sloping from within normal limits to a moderately-severe high-frequency loss. Data collection included a comprehensive hearing evaluation, real ear measures for verification of prescribed gain, Melodic contour recognition and segregation (anglesound), SSAP (Seattle singing accuracy protocol) and a validation questionnaire (SASS- Self-assessment of Amplification with Singing Scale), which was created for the purpose of this study. Additional participants have been recruited to expand the single subject case study, and do a case-series design. The results with amplification included subjective measurement of participants' self-perceived reactions of confidence, perceived accuracy, engagement, and expectations. Outcomes with properly fit (verified) amplification resulted in enhanced pitch discrimination, and music perception scores, however the Seattle Singing Accuracy Protocol resulted in a robust (34%) improvement in singing imitation accuracy. The case study suggests that the SSAP would be a promising tool to validate (measure benefit outcomes with) amplification fitting for singers.

Title: From Query Recommendation to Energy-Efficient Database Systems

Primary Author: Peixiong He

Additional Authors:

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: In this research, we aim to analyze past SQL queries to forecast the subsequent SQL queries a user may execute by a deep learning approach. This involves predicting the exact rows and columns a user is likely to access next, thereby minimizing data transfer times, delays, and energy consumption. Tables frequently accessed are classified as hot data tables (nodes), while those seldom accessed are labeled as cold data tables (nodes). The objective is to enhance the energy efficiency of database systems by maintaining cold nodes in a low power state for extended duration and diminishing the frequency of power state transitions.

Title: Explicating and validating the potent pharmacodynamic actions of Isoliquiritigenin (ISL) in the Treatment of Glioblastoma Multiforme

Primary Author: Peter Weglarz

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Glioblastoma Multiforme is the most aggressive form of glioma and is classified as a grade IV astrocytoma. Glioblastoma is responsible for approximately 15,000 deaths per year, with increasing cases of the disease worldwide. However, there are very few potent and affordable therapeutic approaches with minimal adverse drug reactions.Isoliquiritigenin (ISL) is a natural bioactive obtained from the roots of licorice plants such as Glycyrrhiza uralensis and Glycyrrhiza glabra. Isoliquiritigenin is a chalcone (a collective of flavonoids with an α, β-unsaturated carbonyl group attached to two aromatic rings). Isoliquiritigenin exhibits the properties of Histone Deacetylases (HDACs), enzymes that remove acetyl groups from histones and regulate the expression of specific genes. Other Histone Deacetylation inhibitors (HDACs) such as Quercetin and Luteolin (both flavonoids) reverse chromatin acetylation (reaction from malignant cells) and alter the transcription of tumor suppressor genes such as p53. There is currently no research supporting the actions of ISL as an HDAC to cross the blood-brain barrier and suppress tumor growth.This study will explicate the neuroprotective effects of Isoliquiritigenin against cognitive impairment and proliferation of malignant cells, thereby determining its viability as a primary therapeutic option or as a pharmacological adjuvant for Glioblastoma Multiforme patients suffering from TMZ-resistant tumors.The expected pharmacodynamic action is Isoliquiritigenin, combined with the existing approved chemotherapeutic TMZ, which will catalyze histone modification to restore and maintain cellular memory in patients with Glioblastoma, ultimately preventing significantly higher glioma formation.

Title: Evaluation of pharmacokinetics and antitumor activity of the novel pan-RAS inhibitor ADT-1004 in mouse models of pancreatic ductal adenocarcinoma.

Primary Author: Peyton Johnson

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Pancreatic Ductal Adenocarcinoma (PDA) ranks as the fourth most lethal cancer in the United States, with a five-year survival rate of approximately 10% and a projected annual death toll of 60,000 by 2030. The high mortality rate is often attributed to late-stage diagnosis and the prevalence of KRAS driver mutations. Existing KRAS-targeted treatments are primarily designed to inactivate KRAS-G12C mutants, leaving the more common PDA mutations, KRAS-G12D, KRAS-G12V, and KRAS-G12R, unaddressed. This underscores the urgent need for new RAS-targeted therapeutics that can effectively treat tumors with these prevalent mutations, thereby reducing the PDA disease burden. We have developed a new class of pan-RAS inhibitors with unique biological and desirable pharmaceutical properties. ADT-1004, a prodrug, generates an active metabolite, ADT-007, which effectively inhibits the growth of both human and murine PDA cell lines *in vitro*, demonstrating single-digit nM IC50 values regardless of the specific RAS mutational codon or isozyme. This is achieved by inhibiting activated RAS and downstream signaling of KRAS (ERK1/2 and AKT phosphorylation). ADT-1004 is well-tolerated, exhibiting no noticeable toxicity at oral doses up to 175 mg/kg twice daily. Pharmacokinetic studies reveal that ADT-1004 maintains sustained plasma concentrations of ADT-007, approximately 50-fold above IC50 values, with even higher concentrations observed in both subcutaneous and orthotopic pancreatic tumors. Daily oral administration of ADT-1004 significantly curbs the growth of orthotopically implanted PDA tumors. As a first-in-class pan-RAS inhibitor, ADT-1004 offers potential advantages over mutant-specific KRAS inhibitors, including enhanced efficacy and the ability to circumvent resistance mechanisms. These findings pave the way for future clinical trials of ADT-1004 in the treatment of pancreatic cancer and other RAS-driven cancers.

Title: Acute exercise impacts heart rate variability but not cognitive flexibility during subsequent simulated firefighter occupational tasks

Primary Author: Philip Agostinelli

Additional Authors: William Murrah;Matthew Miller;Christopher Brooks Mobley;Parker Jones;Braxton Linder;Nicholas Bordonie;

Department/Program: School of Kinesiology

College: College of Education

Abstract: Abstract: Background: Acute exercise can transiently enhance cognitive flexibility. It is unclear if resistance and aerobic exercise produce similar affects, and if performing them on-shift translate to improvements in cognitive performance during subsequent firefighter occupational tasks. Time and frequency domain metrics of heart rate variability (HRV) are a proposed physiological factor in which exercises influences cognition as they help discern information related to cardiac autonomic (sympathetic/parasympathetic) function. Therefore, we aimed to determine how a bout of resistance or aerobic exercise impacts cognitive flexibility during firefighter occupational tasks and its relation to heart rate variability. Methods: 32 participants completed five sessions comprised of baseline assessment baseline Wisconsin Card Sorting Task (WCST) and three trials: resistance exercise (RE), aerobic exercise (AE), or rested control (CON). An occupational task assessment (OTA) involving four rounds of 10 deadlifts and 0.15-mile sandbag carry) in an environmental chamber (35�C/50 percent humidity) was completed after each trial. The second round was followed by the WCST. Repeated measures ANOVAs were utilized to analysis differences by condition. Results: Total, perseverative, and non-perseverative errors did not differ by condition (ps > 0.39). Average reaction time of WCST response did not differ by condition (p = 0.11). WCST time was not different by condition (p = 0.28). Time domain HRV metrics were not different by condition (ps > 0.05). All frequency domain HRV metrics other than low frequency power was not different by condition (ps > 0.24). Low frequency power a was different by condition (p = 0.03). Conclusions: Our findings suggest that an acute bout of on-shift aerobic or resistance exercise may not impact cognitive flexibility or response reaction time during subsequent occupational tasks, despite an increased sympathetic drive following aerobic exercise.

Title: Immunohistochemical Comparisons across Mammalian Nasal Cavity Microenvironments

Primary Author: Pia Laporte

Additional Authors: Melissa Singletary;Ludmila Globa;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: It remains unknown how differences in the respiratory and olfactory nasal cavity microenvironments influence function within and across species. The microenvironment of other mucosal sites, such as the gastrointestinal tract, demonstrate an integral relationship regarding the function of epithelial development, immunological regulation, and overall homeostasis. This limited understanding of the olfactory and respiratory nasal cavity microenvironments is being addressed through gross anatomical, histological, immunohistochemical, and microbiotal comparisons between the nasal cavities of dogs, rats, and cats. Nasal cavities of each species were dissected for Respiratory Epithelium (RE) and Olfactory Epithelium (OE) from the nasal septum and ethmoidal turbinates. Tissues were preserved in Bouin's fixative and stained with H

Title: Developing Engineered Biochar for Mitigating Nitrous Oxide Emission from Agricultural Soil

Primary Author: Pradip Adhikari

Additional Authors: Sushil Adhikari;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Nitrous oxide (N_2O) is among the three major greenhouse gases that contribute to global warming and the depletion of the ozone layer. Soil management in the agricultural system has contributed to the greatest emission of N_2O mainly with the extensive use of nitrogen-based fertilizers and animal manures. Biochar amendment is proposed as one of the promising climate-smart agricultural practices to mitigate soil N_2O emissions. However, the effectiveness of biochar input on lowering N_2O in soil remains uncertain. This study seeks to develop engineered biochar via physical and chemical methods to reduce nitrous oxide emissions from agricultural fields. We hypothesize that biochar-pretreated sulfurous compounds will help in lowering N_2O emissions. Pine biomass was pre-treated with three doses of thiosulfate, and pyrolyzed at three temperatures (500 Celsius, 600 Celsius, and 700 Celsius) under a nitrogen environment with a residence time of two hours to produce sulfur-modified biochar. The yield of biochar varied from 30% to 20%. The produced biochars will be characterized using various analytical instruments (elemental analysis, X-ray diffraction, Fourier transform infrared spectroscopy, Scanning Electron Microscopy, and surface area analyzer) to study different physical, chemical, and surface properties of the modified biochars. The modified biochars will further be used for nitrogen adsorption-desorption kinetic studies for evaluating the contribution of nitrous oxide emissions from different nitrogen sources. It is expected that the findings of this research will help to understand the mechanism of modified biochar surface functionality and structure on nitrogen capture and transformation for lowering nitrous oxide emission.

Title: Effect of varying hydrophobic chain lengths and two different charged structures on alcohol-carboxylate co-transport in cation exchange membranes

Primary Author: Pravin Parasakthi Aravindhan

Additional Authors: Bryan Beckingham;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Understanding multi-component transport through ion exchange membranes is essential for designing innovative devices such as photoelectrochemical CO2 reduction cells (PEC-CRC). Of particular interest is the alcohol-carboxylate co-transport as transport of one of the components behaves differently in the presence of other, and vice-versa. Previously, our group observed increased acetate (a carboxylate) transport in the presence of fast diffusing methanol (alcohol) in poly(ethylene glycol) diacrylate (PEGDA) containing crosslinked films. The incorporation of charge-neutral monomers such as poly(ethylene glycol) phenyl ether acrylate (PEGPEA) with PEGDA reduced this undesirable transport. The addition of charged sulfonate-containing ionic groups such as 3-sulfopropyl methacrylate potassium (SPMAK) enhanced ionic conductivities (σ). To further investigate these observations, different neutral and charged monomers of varying chain lengths were incorporated towards resisting solute transport and enhancing σ. Neutral monomers include phenyl acrylate (PA), ethylene glycol phenyl ether acrylate (EGPEA), or PEGPEA, and charged monomers include SPMAK or 2-methyl-2-propene-1-sulfonic acid (MPS). Solute transport to formate and acetate shows higher formate transport in all membrane compositions. Solute transport is also found to be independent of neutral monomers, suggesting that alkyl chain length has minimal effect on resisting solute permeabilities. MPS-containing films exhibit higher solute transport and σ than SPMAK-containing films, possibly due to higher charge content in the lower chain length of MPS. Further investigations on alcohol transport and alcohol-carboxylate co-transport are necessary to understand the interrelation between transport-structure-physiochemical properties of these crosslinked films.

Title: Impact of “artificial intelligence” and holistic herb “cannabis” in the prevention and treatment of “diabetes mellitus”

Primary Author: Preston Cook

Additional Authors: Courtney Alexander;Muralikrishnan Dhanasekaran;Suhrud Pathak;Timothy Moore;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Diabetes mellitus (DM) is characterized by impaired insulin function, resulting in elevated blood glucose levels. The prevalence of DM has been escalating globally and poses a significant global health burden due to long-term sequelae such as blindness, kidney failure, heart attack, stroke, cognitive impairment, and lower limb amputation. Individually, artificial intelligence (AI) and cannabis have garnered significant attention for their potential benefits in managing various health conditions. However, the combined impact of cannabis and artificial intelligence on individuals with DM remains unexplored. Conventional treatment approaches, including pharmacotherapy, nutraceuticals, and lifestyle modifications, often fall short of achieving optimal glycemic control and preventing DM-induced complications. AI technologies, particularly machine learning algorithms, offer the promise of personalized diabetes mellitus care by analyzing vast datasets encompassing patient demographics, medical history, and biomarker profiles resulting in early detection of hyperglycemia, insulin deficiency/resistance, disease progression, and optimized treatment regimens tailored to individual needs. Furthermore, AI-powered continuous glucose monitoring systems enable real-time monitoring of glucose levels, empowering patients to make informed decisions regarding their dietary and lifestyle choices. Complementing the advancements in AI, cannabinoids emerge as a potential adjunct therapy for DM management due to diverse pharmacological properties, including anti-inflammatory, antioxidant, and immunomodulatory effects. Preclinical studies suggest that cannabinoids may improve insulin sensitivity, attenuate inflammation in pancreatic tissue, and mitigate DM-related complications. Integrating AI algorithms and cannabis holds promise for personalized, holistic approaches to DM management, optimizing glycemic control, mitigating complications, and enhancing quality of life.

Title: Decision to use pesticides and precautions by indian farmers

Primary Author: Pritam Mitra

Additional Authors: Ruiqing Miao;Samir Huseynov;

Department/Program: Agricultural Economy and Rural Sociology

College: College of Agriculture

Abstract: Loss of food grains due to attack by pests has always been a problem to farmers around the globe across economies. food rain loss due to pest attack is a bigger problem when it comes to the developing parts of the world which is often characterized by a growing population and larger demand for food. Over the years the use of pesticides has been the insurance against pest attacks but often it leads to the problem of over use and misuse. In this paper we stress on the fact that a representative farmer from a developing country faces a choice of not whether to use or not use pesticides but of how much to use and how to properly use them. With primary data collected from villages in rural India we show what are the factors that affect the farmers' decision making when it comes to using pesticides and precautions and as well as their information sources. This paper shows how farmers rely on pesticide sellers and friends and friends for their knowledge about dosage instead of agricultural extension agents and also choose to ignore the dosage information on the bottles. We also find the underutilization of easily available and cheap precautions during the application of pesticides. The paper sheds light on some of the key aspects which could be avoided by government intervention.

Title: Biochar-based polymer composites for investigations into mechanical and morphological properties

Primary Author: Rachel Day

Additional Authors: Yucheng Peng;Ke Zhan;Sushil Adhikari;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Polylactic acid (a biodegradable, plant-based polymer), or PLA, is one substitution for traditional, polluting plastics due to its promising mechanical properties, though its expensiveness hinders widespread use. Therefore, it is common for researchers to explore filler materials to replace portions of the expensive polymer matrix. Biochar is the solid byproduct of biofuel production, and due to its high carbon content, thermal stability, and use as a soil amendment, it shows promise in its implementation into sustainable polymers. At low filler percentages, biochar can improve mechanical properties due to its porous structure, but aggregates at higher percentages, leading to mechanical failures. Little attention has been given to the additives incorporated into the PLA/biochar composite. This research explores the effects of adding two plasticizers, polyethylene glycol and Struktol, as well as cork particles, in concentrations of 1 wt. percent and 3 wt. percent. Tensile, flexural, and impact testing were done to compare the composites to their neat PLA counterparts. Scanning electron microscopy (SEM) was used to analyze the pine-based biochar and additive dispersion in the PLA matrix. Differential scanning calorimetry and thermal gravimetric analysis were used to look at the thermal properties and find changes in the melt temperature and degradation. Both 1 wt. percent and 3 wt. percent of PLA/biochar/cork composites were found to be comparable to that of the PLA/biochar composite for tensile strength. Izod impact testing showed consistent impact strength among all samples, regardless of filler or additive. SEM revealed good biochar dispersion within the composite, with the cork composites having the least aggregation out of all additive-based composites.

Title: Analyzing the infection efficiency of CLRDV in G. hirsutum and N. benthamiana by agroinoculation

Primary Author: Rachel Livingston

Additional Authors: Kathleen Martin;Wilson Clark;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Cotton Leafroll Dwarf Virus (CLRDV) was first detected in Alabama in 2017 and has since spread across the Southern US. This virus causes stunting and yield loss in cotton, a crop worth over 346 million dollars in Alabama in 2022. It is a 5.8 kilobase, single-stranded positive-sense RNA virus that is transmitted the cotton-melon aphid (*Aphis gossypii*), which has a worldwide distribution. A clone of the Alabama strain of CLRDV was used to study the infection rate and host range of the virus. To do this, *Agrobacterium*-mediated infiltration of the clone of CLRDV into *Gossypium hirsutum* and *Nicotiana benthamiana* was done to study the infection efficiency. Infiltrations were done on 4 replicates each in cotton and benth. Root and leaf samples were collected from *G. hirsutum* and *N. benthamiana* respectively, and detection assays were run to determine CLRDV infection. In *G. hirsutum*, the rate of infection ranges from 40-80%; however, in *N. benthamiana* the infection rate was more variable, ranging from 10-80%. As the clone has been confirmed as infectious and reproducibly detectable, we can turn our efforts towards further study of the virus. With a viable means of testing cotton lines, we can determine resistance to CLRDV and increase yields in the field.

Title: Effect of varied calcium levels and limestone particle sizes on intestinal microbiota in broilers under subclinical necrotic enteritis challenge

Primary Author: Rana Waqar Tabish

Additional Authors: Ruediger Hauck;William Dozier;Matthew Bailey;Samuel Rochell;Wilmer Pacheco;Eva Guzman Guzman;Jose Rodrigo Hernandez Garcia;Jose Isaac Vargas Patino;Joseph Gulizia;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Toxins made by Clostridium perfringens (C. perfringens) as it develops in the intestinal tract of birds are what cause necrotic enteritis (NE). High levels of readily soluble calcium in poultry diets can increase the incidence of NE by favoring the growth of C. perfringens. This study aimed to investigate the impact of varying dietary calcium concentrations and limestone particle sizes on the intestinal microbiota of broilers under a subclinical NE challenge. A factorial design was employed, with six treatments subjected to the NE challenge and one unchallenged control. The main factors included different calcium concentrations (standard, reduced, and low) in the starter, grower, and finisher diets and limestone particle sizes (coarse and fine). The unchallenged control received a standard calcium concentration and small limestone particle size. On day 14, a tenfold dose of live coccidia vaccine was given, and on day 18, 10^8 CFU C. perfringens were given by mouth. Jejunal content was sampled on day 21 for investigating the intestinal microbiota using 16S rRNA sequencing and was analyzed using the Qiime2 pipeline and phyloseq package in R. Alpha diversity indices showed no significant differences among treatments, although a trend suggested the unchallenged control had higher evenness and richness. Beta diversity analysis revealed significant treatment effects ($P < 0.05$, PERMANOVA), with the unchallenged control and the adequate calcium concentration group differing significantly from the low calcium group. Predicted metagenomic analysis indicated differential gene regulation across treatments, with the highest variation observed between the negative and positive controls. In conclusion, the subclinical NE challenge altered the taxonomic composition of the intestinal microbiota, with minimal changes in beta diversity and no significant impact on alpha diversity.

Title: Comparative life cycle assessment of pure hydrogen production through methane decomposition using biochar and Ni/Al_2O_3 catalysts

Primary Author: Raziyeh Jokar

Additional Authors: Sushil Adhikari;Hossein Jahromi;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The production of hydrogen and solid carbon from catalytic methane decomposition (CMD), represents an environmentally friendly method that mitigates CO_2 emissions associated with fossil fuel utilization. Numerous active metals are recognized for their capability to decompose CH_4 into carbon and hydrogen, but the persistent issue of catalyst deactivation remains a substantial challenge. Herein, we have studied a sustainable solution for hydrogen production via methane decomposition, emphasizing the environmental advantages of utilizing biochar as a catalyst instead of the widely used Ni/Al_2O_3 catalyst. Notably, catalyst deactivation is desirable in the case of biochar because it enhances the carbon content of the original carbonaceous catalyst. Thus, the catalyst regeneration and/or carbon-byproduct separation steps can be eliminated from the entire process, allowing to sustain the CMD process for a desired period. To assess the environmental impact of the CMD process, we conducted an attributional Life Cycle Assessment (LCA) comparing Ni/Al_2O_3 and biochar-based catalyst synthesis, following ISO 14,040 and 14,044 standards, using OpenLCA 2.0 software and the ecoinvent 3.9.1 database. This LCA case study was carried out based on the TRACl 2.1 impact assessment. Considering 1 kg H_2 production as the functional unit, the system boundary followed a cradle-to-gate approach. In the case of the biochar catalyst, downed timber was pyrolyzed using a rotary kiln at 450 degrees C. In the Ni/Al_2O_3 system, catalyst regeneration was incorporated for a more realistic design. Economic allocation considerations were applied to both carbon and hydrogen production, ensuring a comprehensive evaluation. The findings revealed that the production of the required heat from sources other than electricity in the biochar case diminished the environmental impact of CMD using a biochar catalyst. The global warming effect for the overall CMD process with 70% CH_4 conversion showed 51.55 kg CO_2 eq and 35.11 kg CO_2 eq for Ni/Al_2O_3 and biochar catalysts, respectively.

Title: Investigation between gender performativity and identity development for engineers

Primary Author: Rebecca Strain

Additional Authors: Eric Burkholder;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: We recently adopted gradational measures of gender identity and expression, which revealed that many students in physics experience discrepancies between how they think about their performance of gender and how that performance is perceived by their peers. Thus, we conducted semi-structured interviews with X students from physics classes to determine how closely they identify with gender normativism (femininity, masculinity, androgyny), and how they believe others would perceive them. The students offered insight into how they think about their performance of their gender, how the climate around them aligns with or contradicts their perceptions, and how they adapt to potential contradictions. Those who are gender non-conforming (those who do not identify as exclusively male or female) offer suggestions for how the university and culture can be altered to be more welcoming to those who do not fit the typical gender narrative. We also explored how students perceived the relationships between their gender, sexuality, and race in the university environment. We believe the implications of this work will allow for further insight into the idea of gender performativity among women in STEM majors, and how institutions are able to utilize this data as more women join these male-dominated fields.

Title: Enhancing sentiment analysis in african languages with transformer-based models

Primary Author: Robert Spicer

Additional Authors: ;

Department/Program: Auburn University at Montgomery

College: Auburn University at Montgomery

Abstract: Sentiment analysis is a crucial aspect of natural language processing (NLP) that has garnered significant research interest. However, the emphasis has predominantly been on languages with ample resources and data, leaving the study of languages with limited data, especially low-resource languages, in need of more focus. To tackle this gap, we introduce a transformer-based approach specifically designed for sentiment analysis in under-researched African languages, namely Nigerian Pidgin and Yoruba. Our method's efficacy was tested through our participation in the AfriSenti SemEval shared task 2023 competition, where our team, Bhattacharya_Lab, achieved remarkable results. We secured the top position out of 33 teams for the Monolingual Sentiment Classification in Nigerian Pidgin (Track 4) and were among the top 5 for Yoruba (Track 2). These outcomes underscore the capability of our transformer-based models to enhance sentiment analysis in languages with scarce resources. This research underscores the critical role of investigating NLP's potential in low-resource settings and the significant impact that transformer-based multilingual models can have on sentiment analysis for African languages like Nigerian Pidgin and Yoruba, highlighting the necessity for further exploration in this area.

Title: Development of a systematic approach to estimate mix-specific dryer burner fuel consumption at asphalt plants

Primary Author: Rohith Reddy Vangala

Additional Authors: Benjamin Bowers;Suri Gatiganti;

Department/Program: Civil Engineering

College: Samuel Ginn College of Engineering

Abstract: The objective of this study is to formulate a systematic approach for accurately estimating the specific fuel consumption of dryer burners at asphalt plants. This methodology utilizes the plant's available annual energy data, a valuable resource often collected for the development of asphalt mixtures' Environmental Product Declarations (EPDs). The conventional practice of relying on a 12-month average of burner fuel and electricity consumption for EPDs lacks specificity, especially in discerning differences in emissions between mix types during the production stage of asphalt mixtures. The proposed approach based on thermo-dynamic principles goes beyond the conventional methods by considering various factors influencing burner fuel consumption. It takes into account the flue gas losses resulting from high stack temperatures in both hot mix asphalt (HMA) and warm mix asphalt (WMA). Additionally, it addresses heat loss due to moisture present in the fuel and vapor formation after combustion. Subsequently, through back-calculation of the plant's other conductive and radiative heat losses, it seeks to evaluate the potential burner savings achievable by adopting improved stockpile management and insulation of the rotary drum. The formulated methodology was validated with field burner fuel consumption data from an earlier study. The significance of this research extends to environmental considerations and sustainable practices. As governments increasingly implement green procurement policies, the methodology presented in this study provides valuable information to make informed decisions about asphalt materials based on their energy efficiency and environmental impact.

Title: Outlier detection with Cluster Catch Digraphs

Primary Author: Rui Shi

Additional Authors: Elvan Ceyhan;

Department/Program: Department of Mathematics and Statistics

College: College of Sciences and Mathematics

Abstract: Cluster Catch Digraphs (CCDs) constitute a set of clustering algorithms incorporating directed graphs, local density, and distribution methods. They employ hyperspheres to identify cluster structures, with KS(Kolmogorov-Smirnov)-CCDs and the almost parameter-free RK(Ripley's K)-CCDs being two variants. We've developed an outlier detection technique starting with RK-CCDs to form hyperspheres around clusters, followed by using KS-CCD to create a Mutual Catch Graph (MCG) for outlier detection, called the M-CCD algorithm. Due to shortcomings of the RK-CCDs' performance in high dimensions, we introduce NN-CCD, improving upon RK-CCDs with the Nearest Neighbor Distance (NND) method. Another method we propose is the M-NNCCD algorithm, which performs well even in high-dimensional settings. We will also briefly touch base upon other developments and methods we are proposing on this topic.

Title: A Kinematically Informed Approach to Near-Future Joint Angle Estimation at the Ankle

Primary Author: Ryan Pollard

Additional Authors: Michael Zabala;Ivan Enrique Nail Ulloa;David Hollinger;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Seeking to align an assistive device's kinematic trajectory with a user's intended motion has been shown to promote fluidity within the human-machine interface. However, the elevated runtimes of commonly deployed machine learning and neural network algorithms make their inclusion difficult in near-future joint angle estimation applications. As such, simple, non-machine learning approaches may be worth considering given their potential to reduce necessary estimation runtimes. This study aimed to develop and analyze the performance of analytically governed models that prioritize historical joint kinematics when estimating near-future joint angles. Five kinematically informed and extrapolation-based methods were developed for joint angle estimation at three near-future estimation horizons: t_{pred} = 50 ms, 75 ms, and 100 ms. Estimation errors and required runtimes of each prediction algorithm were evaluated on the sagittal plane ankle angles of 24 individuals who performed three level-ground walking trials. Results showed that the kinematically informed models had significantly faster estimation runtimes than Random Forest (RF) machine learning models trained and tested on identical datasets (kinematic models: $t_{run} < 0.62$ ms, RF models: $t_{run} > 8.19$ ms for all estimation horizons). The RF models exhibited significantly lower prediction errors than the kinematic models for estimation horizons of t_{pred} = 75 ms and 100 ms, but no significance was found between the top-performing kinematic model and the RF models for a t_{pred} = 50 ms. These results indicate that a kinematically informed approach to joint angle estimation can serve as a simple and viable alternative to complex machine learning models for very near-future applications ($t_{pred} \leq 50$ms) while serving as a baseline for more distant estimation horizons ($t_{pred} \geq 75$ ms).

Title: Thermal Cycling Test of Circuits Fabricated with Water-based Ink and Room-Temperature Curable Adhesives

Primary Author: Sabina Bimali

Additional Authors: Pradeep Lall;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Earlier iterations of flexible electronic devices were typically constructed using interconnect materials that needed higher temperatures to cure at. These interconnects offered benefits like reduced resistivity and enhanced mechanical durability. However, they also came with drawbacks such as heightened energy consumption and the need for substrate materials capable of withstanding high heat. Furthermore, the initial development of printed electronics relied on carrier inks containing volatile organic solvents. This research investigates methods to achieve interconnects that can operate at room temperature, employing water-based inks in printed electronics. The primary focus of the study is to evaluate the electrical performance and reliability within operational electronic circuits. It compares the performance of interconnects processed at low temperatures, utilizing water-based inks, with those processed at high temperatures for both individual components and functional circuits. A differentiator circuit is fabricated using aerosol jet printing, employing both high-temperature and low-temperature interconnects for component attachment. The circuit's magnitude and phase response are then compared with the expected theoretical output. Manufactured circuits are examined for consistency of performance and reliability under thermal cycling in the -40 degrees C to 85 degrees C range, as required for automotive grade-3 components. This research provides insight into the potential of more sustainable electronics through the utilization of water-based inks and low-temperature adhesives.Keywords: flexible printed electronics, high-temperature processable interconnects, low-temperature processable interconnects, non-sustainable inks, water-based inks, aerosol jet printer.

Title: Assessing putative host specific secreted proteins for cotton in *Fusarium oxysporum*.

Primary Author: Sabita Gyawali

Additional Authors: Jeffrey Coleman;

Department/Program: Plant Pathology

College: College of Agriculture

Abstract: *Fusarium oxysporum* includes soilborne fungi that affect more than 120 plant species. They exhibit host specificity and are categorized into distinct *formae specialis*; an example of this is *<<formae specialis vasinfectum (Fov),* a pathogen virulent on cotton. In this context, it's important to note that characterized virulence factors may not function similarly in other isolates that are virulent on different plant hosts. Frequently, small secreted proteins, termed effectors, contribute to virulence by repressing the immune response of the infected plant. This research aims to elucidate conserved host-specific effectors for cotton in *Fusarium oxysporum f. sp. vasinfectum*. Using comparative genomics, putative effectors were identified from 12 *Fov* genomes (cotton isolates) and 10 *F. oxysporum* genomes (non-cotton isolates). Surprisingly, no single orthogroup was exclusively shared among *Fov*. However, 11 orthogroups were found specifically in the highly virulent Race-4 genotype of *Fov*. To further narrow down unique putative effectors, in-planta gene expression using qRT-PCR was conducted, and five genes exhibiting significantly higher expression during infection were identified. Three of these genes were found as a single copy in the Race 4 genome of *Fov*, and they were selected for gene disruption using CRISPR-Cas9 technology. The generated mutants will be evaluated for their pathogenicity on cotton. This comprehensive approach aims to elucidate the involvement of these specific genes in the virulence of *Fov* on cotton plants and may provide potential targets for the development of effective strategies for managing Fusarium wilt in cotton.

Title: Assessment of Microplastics Abundance in Alabama River System

Primary Author: Safeerul Islam Hashmi

Additional Authors: Andrew Barrick;Tham Hoang;

Department/Program: FAA Fisheries and Allied Aquacultures

College: College of Agriculture

Abstract: Rapid increases in plastic pollution have received increased attention recently, especially with microplastics (MPs) that are plastic particles at sizes of ≤ 5mm. To understand potential ecological impacts of MPs, characterizing the abundance and distribution of MPs in aquatic ecosystems is necessary. Studies have been carried out in different regions to detect MPs. However, only a little information on MPs abundance in the US river system exists. Information on MPs in the Alabama River system has not been reported. This study is designed to evaluate the abundance of MPs in the Alabama River. Seasonal sampling campaigns (i.e., summer, fall, winter, and spring) collected water samples at 5 selected sites (Wetumpka, Dixie landing, Selma, Montgomery, and Mobile Bay) to detect the MPs abundance. Physical characteristics including size, shape, polymer, and density were determined. The study identified that the count of fragments to be higher than fibers. The highest number of fragments (18/L) was identified in the Wetumpka summer samples whereas the highest number of fibers (5/L) was found in Selma summer samples. These concentrations are within the concentration range of some polluted rivers in the world. Approximately, 22% of the MPs were black in color whereas 18% were white. Rest of the 60% had other colors such as green, blue, red etc. Samples collected in other seasons are under analysis. The results of the summer samples reveal a potential variation in MPs abundance by location. This study serves as a benchmark on microplastic distribution in Alabama’s river systems. Follow-up ecotoxicity studies will assess the hazard associated with the MPs found in the river system.

Title: Linear regression model to predict the feeding rate in a laboratory-scale gasifier

Primary Author: Sagar Kafle

Additional Authors: Sushil Adhikari;Ashish Bhattarai;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The solid fuel feeding problem is a critical challenge for a gasifier's sustainable and efficient operation. The feeding system frequently gets clogged, and in a volumetric feeder, the feed rate typically reduces during operation. As the operating parameters of the gasifier depend upon the feed rate, it should ensure proper feeding for optimal output. Considering the issues, the study first investigated the parameters on which feed rate varies and then, based on the parameters, developed a predictive linear regression model in RStudio. The data required were taken conducting experiments in the gasifier having a screw feeder with the feedstock prepared by crushing hardwood of pine biomass (Pine1), pine residue (Pine2), and municipal solid waste (MSW). It has been found that the feed rate linearly relates to the mass loading in the hopper (R2>0.96), the rotation of the feeding screw (R2>0.99), bulk density (R2>0.99), and particle density (R2>0.90). The model was developed using the data of Pine1 and MSW feedstock considering mass loading and bulk density and demonstrated a high correlation in predicting MSW feed rate (R2 = 0.91). However, the model performed moderate in predicting Pine1 (R2 = 0.75) feed rate and exhibited moderate performance (R2 = 0.78) in validation with the Pine2 measured data. The study needs further refinement, adding more properties to enhance the model's accuracy. The research contributes valuable insights in improving gasifier feed systems.

Title: The effects of green additives in sheared cellulose nanocrystal films

Primary Author: Saim Siddiqui

Additional Authors: Virginia Davis;Tanmay Rahman;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cellulose nanocrystals (CNCs) are rod-like nanomaterials that can be extracted from renewable resources such as wood and cotton. CNC's liquid phase processability and exceptional mechanical properties makes them highly desirable for film applications. However, the inherent rigidity of CNCs often leads to the development of cracks and curls in aligned CNC films. To address this issue, the use of low molecular weight and eco-friendly additives, such as sorbitol, has shown positive effects in mitigating film defects in drop-cast CNC films. However, the effects of sorbitol on the CNC dispersion flow behavior and microstructure of shear-cast CNC films have not been thoroughly explored. This research is aimed at filling this knowledge gap by investigating the effect of sorbitol concentration on the CNC dispersion microstructure and mechanical properties of shear-cast CNC films. Aqueous dispersions of sulfated CNC and sorbitol were shear cast on a polyester substrate at a shear rate of 10 s-1 and dried at room temperature to produce films with varying sorbitol concentration. After drying, the alignment of CNCs within the films was quantified using optical contrast measurements obtained via cross-polarized optical microscopy. In addition, tensile testing was performed on films oriented in parallel and perpendicular to the direction of flow. These results provided new insights into how to lessen the negative effects of cracking and curling in shear cast CNC films, while maintaining the optical and mechanical properties of this eco-friendly nanomaterial.

Title: Studying the species-specific and growing environment related factors of urban forest carbon stocks

Primary Author: Samit Kafle

Additional Authors: Georgios Arseniou;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Studying urban forest carbon stocks is essential to better understand the role of urban trees in climate change mitigation, which has broader implications in forest carbon policy making. This is a prospect research project which will focus on improving our understanding of how carbon stocks of urban trees vary across species of different functional traits within different urban settings. More specifically, we will sample trees of varying drought tolerance that grow in open spaces and near anthropogenic infrastructure (e.g., streets, buildings) on Auburn University campus. We will use Terrestrial Laser Scanning (TLS) technology to generate laser point clouds of the study trees and we will quantify their aboveground woody volume using Quantitative Structure Models (QSMs). We will also sample woody cores from the same trees, and we will quantify their wood density and carbon content using Near Infrared Reflectance Spectroscopy(NIRS). Combining the woody core data with the TLS-based wood tree volumes we will estimate the total aboveground biomass and carbon content of the study trees. This study will provide new insights into atmospheric carbon sequestration of urban trees.

Title: Inhibition of Delta secretase prevents amyloid beta secretion in APP CHO cells.

Primary Author: Sampada Tamhankar

Additional Authors: Rajesh Amin;Joyal Xavier;Meenakshi Singh;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Alzheimer's disease (AD) is a neurodegenerative condition with multiple biomarkers for diagnosis. Traditional pharmacological inhibitors for preventing amyloid-based neurodegeneration have failed at the clinical level. Therefore, alternative potential molecular therapeutic targets are needed for mitigating amyloid beta-mediated neurodegeneration. Our lab is currently focused on investigating how Asparaginyl Endopeptidase (AEP) can serve as an early tool for AD prevention. AEP is a cysteine protease enzyme found in several tissues, including the kidney, liver, and brain. It cleavages asparagine residues in proteins such as Amyloid Precursor Protein (APP) and Transactive response DNA binding protein (TDP-43). Among the proteins linked to AD, APP is known to be modified early in the process, leading to the production of amyloid beta following cleavage. The current study investigates how novel AEP inhibitors prevent APP cleavage and reduce levels of amyloid beta. In the current study, we have used stably overexpressing mutant human APP-CHO cells. These cells were also transiently transfected with an AEP and then exposed to the AEP inhibitors, Compound 11 (10uM) and Asparagine Endopeptidase Inhibitor (AENK) peptide (10uM), in normal and acidic media. The results demonstrated that APP-CHO cells expressing AEP, cleave APP under acidic media conditions, producing alternative, shorter fragments. This result was reconciled with the AEP inhibitor, AENK peptide. The current study provides evidence that AEP is involved in modifying the processing of APP in AD disease conditions, which eventually leads to an increase in Aβ levels within the APP CHO cells, and that inhibiting AEP can thus aid in preventing APP cleavage. Furthermore, adding an inhibitor to the medium produces a reversal in APP processing and a decrease in the smaller fragments.

Title: Exploring the mediating role of adolescents' intentions: Impacts of the PREP program on sexual health indicators and relationship advocacy.

Primary Author: Sandra Anti Eyiah

Additional Authors: Adrienne Marks;

Department/Program: Human Development and Family Studies

College: College of Human Sciences

Abstract: Research suggests that rates of unintended pregnancies, sexually transmitted infections, and HIV are higher in the southern states as compared to other regions. Comprehensive sex education (CSE) has gained much attention, as many studies have shown significant effects on sexual health behaviors and outcomes. However, research studies and evaluations assessing the impact of sex education, specifically in the southern states, are limited. The purpose of this study is to better understand and examine the impact of the Personal Responsibility Education Program (PREP), an evidence-based CSE program, on adolescents' sexual health indicators and relationship advocacy. Also, the current study tests the mediating role of adolescents' intentions on their beliefs and knowledge about sex, as well as relationship advocacy after completing the PREP program. Self-report retrospective data were collected from 501 adolescents from the 2021–2022 and 2023 fiscal years (271 girls; Mage =15.56 years; 79.8% African American). Results showed that there was statistically significant positive indirect effect of adolescents' intentions on beliefs about sex model and knowledge about contraceptives model. Further findings from this study will be discussed.

Title: The effects of captivity on the production of red 4-keto-carotenoids by male Northern Cardinals

Primary Author: Sara Patton

Additional Authors: Geoffrey Hill;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Carotenoid-based coloration is a well-documented example of an honest signal used for mate acquisition in various vertebrate taxa. Production of such ornaments is sensitive to environmental stressors. Here we examined how chronic stress induced by holding a wild bird in captivity, coupled with the annual physiological stress of feather molt, affected red ketocarotenoid pigments in the bill and plasma of Northern Cardinals (Cardinalis cardinalis). Bill color was assessed using Adobe Photoshop while feathers and blood samples will be analyzed using High Performance Lipid chromatography. All birds were supplemented with zeaxanthin and lutein, the dietary yellow pigments necessary for cardinals to produce the red pigment astaxanthin. I observed a significant difference in bill color between captive and wild cardinals. I predict that I will also observe differences between captive and wild males in the amount of circulating carotenoids and the color of feathers that are produced. These observations support the hypothesis that the redness of plumage coloration of male Northern Cardinals is a signal of the condition of individuals during molt.

Title: Performance analysis of joint angle estimation algorithms to control a lower-limb ankle exoskeleton emulator

Primary Author: Sarah Bass

Additional Authors: Michael Zabala;Ryan Pollard;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Performance enhancing exoskeletons allow users to complete tasks at an elevated level by reducing the metabolic cost of an activity. A primary challenge for performance enhancing exoskeletons is predicting the operator's intent to actuate the exoskeleton accordingly. This research effort evaluated two ankle angle predictive algorithms: a kinematic extrapolation algorithm and a Random Forest machine learning algorithm. Predictive algorithms and motor control were implemented to actuate an ankle exoskeleton emulator to evaluate the respective RMSE and delay. The kinematic extrapolation algorithm used a kinematic equation to predict ankle angle and the Random Forest algorithm used a machine learning model trained on ankle angles from previous walking trials. Both models used current joint angles as inputs. The average realization delays of the kinematic extrapolation and Random Forest models were 44 ms and 37 ms, respectively, with no statistically significant difference. The average RMSE values for kinematic extrapolation and Random Forest were 6.3 *degrees* and 5.4 *degrees*, respectively, where differences were highly significant ($p < 0.01$). These results suggest that a machine learning model outperforms a kinematic extrapolation model for this system because the Random Forest algorithm demonstrated a significantly lower RMSE, while not resulting in a significantly increased actuation delay.

Title: Researching beneficial bacteria that help plants survive cold environments

Primary Author: Sarah Hyde

Additional Authors: Kathy Lawrence;John Mcinroy;Deepak Shantharaj;Claire Schloemer;Bernardo Chaves-Cordoba;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Plant Growth-Promoting Bacteria (PGPR) are a diverse group of bacteria that have co-evolved with plants, forming symbiotic relationships that can be mutually beneficial. The study objectives focus on evaluating a collection of Alaskan PGPRs with the aim of understanding their growth characteristics at low temperatures and assessing their potential to enhance plant growth under cold conditions. The growth of 393 bacterial strain colonies was measured at temperatures 4, 22, and 28 degrees Celsius. Corn seeds were treated with an individual isolate at 1x107 CFU/ml and grown in a sandy loam soil at 18 degrees Celsius for eight days, after which seedling mass was weighed in grams. Tests were RCBD with three replications. The 393 Alaskan strains were identified to 51 genera with 175 different species, indicating a diverse community of bacteria was present in the Alaskan flora. Temperature studies found that 10 strains grew well at 4 degrees Celsius. These strains included *Pseudomonas fluorescens* AK202, *P. kielensis/mucoides* AK209, AK313, *P. moorei/vancouverensis* AK314, *P. mucoides* AK186, *P. piscium* AK201and AK385, and *Erwinia billingiae* AK17 and AK376. The corn plant growth data at 18degrees Celsius indicated that the top ten strains increased corn plant biomass significantly over all the remaining strains. Plant biomass showed a 33.6% increase with the addition of the top ten strains. The PGPR cold tolerant strains consisted of *Arthrobacter ginsengisoli* AK48, *Bacillus paralicheniformis* AK43, *B. haikouensis* AK46, *B. cabrialesii/inaquosorum/tequilensis* AK144, *Cytobacillus firmus* AK141, *Luteibacter rhizovicinus/pinisoli* AK79, *Pseudomonas neuropathica* AK214, *P. piscium* AK239 and AK385, and *Solibacillus isronensis* AK318. These tests indicated AK strain 385 *Pseudomonas piscium* grew well at 4 degrees Celsius. and also increased corn plant growth at 18 degrees Celsius. These PGPR strains should be further tested in the field to determine plant survival benefits in the natural environment.

Title: Addressing postoperative complication risk factors and adequate nursing interventions for better outcomes in patients with IDD: a literature review.

Primary Author: Sarah Owens

Additional Authors: Amy Curtis;Leticia Raymundi Pinheiro;

Department/Program: Nursing

College: College of Nursing

Abstract: A surgical procedure, even a small one, puts patients at risk for postoperative complications that could delay healing processes or positive outcomes. In patients with intellectual and developmental disabilities (IDD), these risks are enhanced by factors that revolve around their coexisting medical conditions, in addition to barriers in communication and limited cognitive skills, which impose challenges in achieving the desired outcomes after surgery and providing adequate care. Addressing these risk factors that can turn into complications postoperative is essential to the development of a proper plan of care and adequate nursing management that focuses on improving patient outcomes while highlighting the importance of patient-centered care. This presentation aims to address postoperative complications IDD patients are at higher risk for, (acute renal failure, pneumonia, postoperative bleeding, and septicemia), and the necessary and adequate nursing interventions for each factor to improve patient outcomes. Through reviewing the current literature and the implementation of evidence-based practice, nurses and additional healthcare professionals can mitigate possible complications that can arise postoperatively while congruently enhancing overall comfort and quality of care for IDD patients undergoing surgical procedures.

Title: A systematic review of the relationship between methylenetetrahydrofolate reductase and coagulopathy in populations with sickle cell disease

Primary Author: Sarah Rice

Additional Authors: Courtney Alexander;Adelia Grabowsky;Rachel Rice;

Department/Program: Pharmacy Practice

College: Harrison College of Pharmacy

Abstract: Methylenetetrahydrofolate reductase (MTHFR) is an enzyme responsible for the regulation of folate and homocysteine within the body. Genetic variation in this enzyme commonly occurs via C677T and A1298C. Individuals with sickle cell disease (SCD) and associated hemoglobinopathies may be at increased risk for poor outcomes related to MTHFR variation. Complications of sickle cell disease can range from mild to severe and include coagulopathies such as stroke, thrombotic events, and vaso-occlusive crises. The primary objective of this systematic review was to examine the relationship between MTHFR and coagulopathy in populations with SCD. This review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guideline within the Covidence Systematic Review Tool. A search was conducted utilizing Web of Science, Embase, Ovid Medline, and Dissertations and Theses for publications through October 16, 2023. Search terms utilized were descriptive of sickle cell anemia, methylenetetrahydrofolate reductase (MTHFR) and coagulopathies (e.g. stroke, venous thromboembolism). The search was limited to articles in English language only. A search of all sources resulted in the identification of 178 items, with 119 remaining after de-duplication, which were uploaded to Covidence. Each article was screened by two independent study investigators. Articles were included based on the following eligibility criteria: population included humans with sickle-cell disease (SCD) - HbSS, HbSC, HbS/β0/ or beta-thalassemia; article must include MTHFR genotype and coagulopathy outcomes and assess the association between these two outcomes. Systemic reviews and meta-analyses were excluded. After full-text review, 28 articles were eligible for data extraction and analysis. Data extraction and analysis is currently ongoing. We anticipate presentation of results at The Auburn University Research Symposium in March 2024.

Title: Engaged students: successfully transitioning to college and making social connections

Primary Author: Scotlyn Sims

Additional Authors: Sara Driskell;Lucero Montero;Mary Claire Futch;Darcie Dark;Chloe Brantley;Molly Martini;Natalie White;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Transitioning into college can be either a positive or negative experience depending on the different things you're involved in on campus. Student organizations can also play a role in your social life on campus, including romantic relationships and friendships. We surveyed 320 Auburn first year and transfer students transitioning to Auburn about the student organizations they are involved in, including Greek life, as well as their new friendships and romantic relationships on campus. In general, most students were in 1-2 student organizations, although about 15% were not involved in any yet and 31% were involved in 3 or more organizations. Most of these were pre-career organizations, service/volunteering organizations, Greek organizations, or religious organizations. Just over half of students were involved in Greek life (53%), and only 15% were involved in sports. We found significant correlations between the number of organizations students were involved in and the ease of their transition to Auburn, their sense of place at Auburn, and their overall wellbeing. Greek life participation was also correlated with a better transition to Auburn, increased sense of place here, and better wellbeing. Importantly, being more involved in organizations was also significantly correlated with students' self-reported grades. Sports participation also helped students with higher wellbeing feel a greater sense of place at Auburn. For relationships, students' number of organizations and involvement in Greek life both correlated significantly to students' ease and quickness in finding new friends at Auburn. Better transitions, sense of place, and wellbeing were all significantly correlated with optimism about dating. These suggest that student organizations and Greek life bolster students' transitions to Auburn and help them develop strong social support. Student engagement isn't just about joining clubs; it helps integrate students into campus life and make friends faster.

Title: Artificial Intelligence: Its Role in the Diagnosis and Treatment of Spinal Cord Injury

Primary Author: Scott Lynn

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: The role of artificial intelligence (AI) in healthcare and healthcare administration has been under increasing focus as providers search for more efficient and cost-effective practices. One class of central nervous system-related injuries that may benefit from AI applications is spinal cord injury (SCI). AI will likely play an important role in the administrative tasks in healthcare, possibly lowering the overall cost of SCI treatment. The implementation of AI serves not only to make healthcare more efficient but also may lead to more rapid diagnosis, prevention, and treatment, as these patients generally remain disabled while afflicted with SCI. AI methods such as machine learning and pattern recognition have already been shown an increase the accuracy of imaging-based diagnoses. With SCI patients having symptoms of speech impairment, language processing of these patient-provider interactions may yield highly accurate and useful diagnostic data for physicians through the cross-referencing of many patient symptoms and reports. AI and machine learning also have a place in the interpretation, meta-analysis, and validity of medical data encompassing SCI. Analysis of gross data by AI may demonstrate pattern identification with an efficiency unmatched by current analytical methods. AI has the potential to provide immense benefits in drug development and the discovery of SCI treatments. Genetic analysis, protein structure determination, constitutional analysis, predictive modeling, and synthesis planning have already shown promise with the implementation of AI in drug development. These applications may serve a vital role in developing medications that may alleviate secondary symptoms of SCI and possibly restore some function. The prevalence of SCI and its effects on many aspects of patient life and health provide support for the implementation of AI in the assessment and treatment of SCI.

Title: Sensitivity of Alabama endemic snail species to nickel exposure

Primary Author: Sean Parham

Additional Authors: Tham Hoang;Shannon Brewer;Andrew Barrick;Katie Knight;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Through the Clean Water and Endangered Species Acts, states are obligated to assess how anthropogenic stressors influence ecosystems and impact endangered and threatened species. Alabama has one of the highest percentages of endemic invertebrate species on the continent with 74% of local gastropods imperiled or extinct. Snails have unique ecological niches which are imperiled by land use change and introduction of hazardous chemicals. To assess how alterations to the environment impact gastropods, lab-based studies are needed to characterize the toxicity of specific stressors on gastropod species. This can help guide policy decisions and remediation efforts. The aim of this research was to characterize the acute toxicity of nickel (Ni) towards endemic snails (*Somatogyrous species, Elimia cahawbensis, Elimia species*) and measure bioaccumulation of Ni and mineral elements. Snails were exposed to 6 concentrations (25-800 ug/L) of Ni for 96-hours. Among the studied snail species, E. cahawbensis was the most sensitive to Ni with the lowest lethal concentration (LC) where 50% of the organisms died at 109.27 (19.33-305.72) ug/L Ni. The LC50 for *Somatogyrous sp.* was 186.45 (169.32-209.00) ug/L Ni. *Elimia sp*.'s LC50 was 355.33 (268.71-478.79) ug/L Ni. Except for *Elimia sp.,* mortality of the other two snail species was corresponding to the whole body uptake of Ni. Uptake of mineral elements such as potassium and magnesium was affected by Ni. The effect appeared stronger with *Elimia sp*. at which the uptake of sodium and calcium was also affected. All three endemic species are potential candidate species for characterizing localized impacts of anthropogenic activities, and the study provides a first step in characterizing how snails would be affected by alterations to their environment. More research is needed to further characterize potential effects of other anthropogenic stressors on these endemic snail species.

Title: Computational analysis of structural maturation in human induced pluripotent stem cell-derived cardiomyocytes

Primary Author: Seohyeong Kim

Additional Authors: Elizabeth Lipke;Mohammadjafar Hashemi;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: The human adult heart is largely incapable of restoring its damaged cardiomyocytes (CMs), or human heart cells. Human induced pluripotent stem cells (hiPSCs) have shown promising potential in cardiac regenerative therapy due to their ability to differentiate into cardiomyocytes (hiPSC-CMs). Unfortunately, a major limitation of hiPSC-CMs is their immature characteristics in their cellular and intracellular morphological structures. While many studies assess these maturation features qualitatively, there have been increasing efforts to quantitatively measure them in an unbiased and automatic way. By extracting and enhancing the key functionalities from two MATLAB algorithms, we successfully developed a platform that provides a comprehensive set of morphological parameters that define the maturity levels of hiPSC-CMs. For our computational analysis, we used staining images of hiPSC-CMs obtained from confocal microscopes. Consequently, we used the software to evaluate structural maturation features on a cellular level by measuring cell area, elongation, eccentricity, and circularity. We further analyzed structural maturation features on an intracellular level by first detecting the sarcomeres, or the basic contractile units of hiPSC-CMs, and subsequently measuring their orientation levels, alignment levels, and average length. We confirmed the accuracy of our algorithm by comparing the results to manually obtained data from ImageJ. Due to various morphological features, it can be challenging to gauge the overall maturity of hiPSC-CMs. Therefore, future studies will investigate clinical data to determine the relative significance of each maturation feature and ultimately develop a formula to express the overall maturity level of hiPSC-CMs through a single numerical variable. This novel variable will provide invaluable insights, as it will allow us to compare the maturity levels of hiPSC-CMs that were created through different experimental methods in an unbiased manner.

Title: Predicting the future condition of primary and secondary progressive multiple sclerosis patients following ibudilast treatment using machine learning

Primary Author: Seyedeh Nasim Adnani

Additional Authors: Adil Bashir;Gopikrishna Deshpande;Tom Denney;Phuoc Nguyen Huynh;

Department/Program: Auburn MRI Research Center

College: Samuel Ginn College of Engineering

Abstract: Multiple Sclerosis (MS) is a demyelinating disease in the central nervous system that causes progressive degeneration and brain atrophy. Limited treatments are available for MS, making it essential to analyze how patients respond to new treatment trials. By leveraging machine learning (ML) tools, we sought to understand and predict disease progression in MS patients following ibudilast treatment, providing valuable insights into treatment efficacy. Data comes from the NN102/SPRINT-MS study. While previous studies required 96 weeks of extensive monitoring and screening visits to determine ibudilast's effectiveness, we predicted treatment outcomes based on available baseline information on the first visit. This approach offers the advantage of reducing the number of screenings and lowering costs. In particular, we predicted the rate of change in the brain parenchymal fraction (bpf) in patients with ibudilast and placebo in week 96 using the baseline information. The estimated rates of change in bpf showed a significant difference between the ibudilast and placebo groups (P=0.03), slowing down from -0.0034 per year with placebo to -0.0013 per year with ibudilast. We further implemented a deep Neural Network to differentiate between MS subtypes (Primary or Secondary Progressive MS). This can help plan appropriate treatment strategies and improve the patient's quality of life. The network achieved (70±2) percent accuracy with 5-fold cross-validation. This accuracy indicates the complexity of the classification task, especially as the two subtypes share many MRI features and pathogenic similarities. In summary, we conducted a machine learning-based diagnosis and prognosis for progressive MS patients undergoing ibudilast treatment over 96 weeks. We predicted the rate of change in bpf after 96 weeks into the trial. The results showed an approximate 62 percent relative difference between the two treatment groups, confirming the efficacy of ibudilast in mitigating brain atrophy.

Title: The contributions of artificial intelligence to neuroscience

Primary Author: Shannon Kim

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: The inability of electrical impulses to pass through the brain and nervous system causes neurological diseases, which in turn causes the peripheral or central nervous systems to be unable to function properly. It is well recognized that neurological illnesses are a substantial source of disability and the second most common cause of mortality worldwide, disproportionately impacting those in low- and middle-income groups. The number of neurological disorder-related fatalities and impairments is predicted to increase over time due to population growth and aging. Around the world, society is severely burdened by the cost of treating neurological and neurodegenerative conditions. The use of pharmacologic medicines are a well-known strategy for treating neurological and neurodegenerative illnesses, which can be used in various ways to treat a wide range of patient symptoms. However, due to the drawbacks of pharmacotherapy and other forms of treatment, primary research has gradually aimed into the complete avoidance of neurological and neurodegenerative illnesses and has made progress in several areas. Novel neuroprotective treatment targets that have been found as pathophysiologic processes of neurological and neurodegenerative diseases have been further characterized. In the past several years, artificial intelligence has found use in diagnosing, prognosis and treating neurological and neurodegenerative illnesses. Most notably, AI methods have shown to be extremely helpful in the identification and diagnosis of many neurological illnesses. Computer-aided diagnostic systems have improved physicians' ability to evaluate and interpret physiological images and signals by applying AI and proficient signal processing techniques. This chapter summarizes the proliferating diagnostic, therapeutic, and preventive impact of Artificial Intelligence (AI) in neuroscience.

Title: Pharmacological analyses of twelve naturally occurring human melanocortin-5 receptor mutations

Primary Author: Shanshan Jiang

Additional Authors: Ya-xiong Tao;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Human melanocortin-5 receptor (hMC5R) is a G protein-coupled receptor (GPCR) that is widely expressed in both the central nervous system and peripheral organs, indicating potential diverse biological functions. It plays important roles in regulating exocrine gland secretion, inflammation, and energy metabolism. Preliminary clinical studies indicated that hMC5R is associated with obesity and type 2 diabetes. Recent genomics studies have identified hundreds of naturally occurring MC5R mutations. Human MC5R is primally coupled to Gas, resulting in increased intracellular cAMP. Herein, pharmacological properties of 12 hMC5R mutants at highly conserved residues were studied by measuring their expression, ligand binding, and signaling. Results showed only Y295H had decreased total expression while I294T had increased cell surface expression. D119Y, P253L, P292S, I294T, and I294M were defective in ligand binding as well as a-MSH-stimulated cAMP production. The remaining seven mutants (P70A, Y141F, R158H, R158L, D291H, Y295C, Y295H) had similar binding affinities for a-MSH as wild-type hMC5R. P70A, Y141F, and R158H had significantly decreased maximal binding and signaling. D291H, Y295H, and Y295C were defective in a-MSH-stimulated Gas-cAMP signaling pathway. Y141F and R158H also had decreased a-MSH potency. In summary, we did not identify any mutant with misfolding defect. Five mutants had defects in binding and consequent signaling. Three mutants had binding but no signaling, with a clear defect in G protein binding and/or activation.

Title: Environmental Initiatives in LEED Platinum Hotels – Best Practices, Challenges, and Efficacy

Primary Author: Shelby Morris

Additional Authors: Imran Rahman;

Department/Program: Hospitality Management

College: College of Human Sciences

Abstract: Despite the vast amount of research done in the realm of sustainable tourism, a gap remains in the realm of the most wholly sustainable lodges in the United States, LEED Platinum certified properties. There are only 65 LEED Platinum hotels and their advanced knowledge of how to achieve peak sustainability without negatively impacting the guest experience is paramount to the future of the industry. There are over 100,000 hotels in the United States and American citizens take over a billion domestic vacations each year which has the potential to have a significant environmental impact. It is crucial to implement sustainable practices in the lodging industry because so much tourism relies on the natural world and green practices will soon become the norm. There are several barriers to entry that exist and prevent the average hotelier from incorporating eco-conscious practices into their facility including a lack of financial resources, no knowledge of best practice, preconceived notions about sustainability etc. In an attempt to learn from the best in the industry, three LEED Platinum properties were contacted. A student did an onsite visit and interview with the staff for both Proximity Hotel in North Carolina and the Len Foote Hike Inn in Georgia along with an email interview with the W in California. The anecdotal information gathered was then further supported by data from several other sources including case studies and academic journals. The qualitative research was able to assert that that the sustainable practices implemented by LEED certified properties did not negatively impact the guest experience, had a positive environmental impact, and did not act as a drain for finances. This further displays that sustainable practices can benefit hotels by helping them keep up with the current market trends while having a positive environmental impact.

Title: Integrated Electrocoagulation: A novel approach for the separation and valorization of lignin

Primary Author: Shoumik Sadaf

Additional Authors: Zhihua Jiang;Tae-Sik Oh;Morteza Taghavi Kouzehkanan;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: The current challenges in the 21st century involve large-scale utilization of non-reusable and non-recyclable resources. As a result, the valorization of biomass-derived materials as a suitable alternative to petroleum-based products has been getting much attention in recent years. Lignin, around 20-25%%20of plant biomass, is the second most abundant organic molecule available on earth after cellulose. This research aims to establish an integrated and sustainable electrocoagulation process for separating and valorizing the lignin from the black liquor after the kraft pulping process. Our approach to achieving this objective is to systemically investigate the combination of different electrodes (Iron and Aluminum) and their configurations on the efficiency of the lignin separation and the functional properties of the lignin. The preliminary results we have obtained show that the yield of lignin separation was 62.03%%20and 90.74%%20using Aluminum and Iron electrodes, respectively, after 6 hours at alkaline pH (pH = 11) applying 20 V DC voltage. We are optimizing the electrocoagulation conditions and configurations, including recycling the effluent after the lignin separation. The obtained lignin will be processed and valorized to generate ordered and magnetic mesoporous carbon for applications as a photocatalyst, catalyst, or adsorbent. In addition, we will perform a techno-economic evaluation of our novel process compared with the LignoBoost process, a conventional lignin separation process from the black liquor.

Title: The Effects of Different Stocking Densities on the Growth Performance of Pacific White Shrimp (*Litopenaeus vannamei*) raised in an outdoor recirculating mixotrophic systems

Primary Author: Shrijan Bajracharya

Additional Authors: Luke Roy;Allen Davis;

Department/Program: School of Fisheries Aquat Science

College: College of Agriculture

Abstract: Stocking density refers to the number of animals stocked per unit area or volume of water. It is a pivotal factor in shrimp cultivation. High stocking density can enhance shrimp production, yet it necessitates greater feed input, potentially leading to water quality degradation. High stocking density has the potential to influence shrimp growth, survival rate, and contribute to stress due to overcrowding. The objective of this study was to evaluate the response of Pacific white shrimp (Litopenaeus vannamei) when cultured at different stocking densities in an outdoor recirculating mixotrophic system. The experiment comprised an outdoor mixotrophic system with 20, 800L blue polyethylene tanks. Shrimp were stocked at varying densities (50, 100, 200, 300, and 400 shrimp per cubic meter) with 4 replicates per treatment and raised for 8 weeks. All treatments were provided a commercial shrimp diet (Zeigler Shrimp Grower HI-35, Crude Protein 35%) four times per day via hand feeding. Feed inputs were proportional to stocking density. At the end of the study, significant differences in growth and feed conversion ratio (FCR) between treatments were observed. The shrimp achieved their maximum mean weight of 16.8 g and a weight gain percentage of 4040%% when cultured at a density of 50 shrimp per cubic meter. A decrease in the final mean weight and weight gain (%) were observed with an increase in stocking density. FCR and final biomass both increased with increasing density. A higher biomass is desirable from a producer standpoint, and higher stocking densities would potentially make this possible. However, overcrowding due to elevated stocking densities has the potential to result in reduced survival, elevated FCR, and diminished water quality.

Title: Strategic Directions for Technology Innovation: The Role of Developers' Social Interaction within Open Source Software Platforms

Primary Author: Sidi Zhao

Additional Authors: Yen-Yao Wang;Uzma Raja;Pei Xu;

Department/Program: Business Analytics and Info Systems

College: Harbert College of Business

Abstract: Firms proactively invest in technology innovation to strategically allocate IT resources to improve business performance. Throughout the innovation process, the diffusion of information is critical in facilitating firms' knowledge acquisition and bolstering innovation endeavors. The developers associated with a firm socialize and learn from other developers in the open source software (OSS) communities outside their parent firm, leading to knowledge diffusion across firms. Despite extensive research on the motivations and benefits of technology innovation, the impact of social interactions amongst developers in OSS on the strategic direction of a firm's technology innovation is less studied. Drawing upon social network theories and link prediction techniques, we propose that the social network links among developers predict the links in the knowledge diffusion network among their firms. To test our hypotheses, we use the social connections among Blockchain developers on GitHub to construct an informal knowledge diffusion network and use the Blockchain-related technology patent citation data from USPTO to establish the formal knowledge diffusion network among firms. Blockchain technology is among the most disruptive technological innovations in recent years and has enormous potential to impact firms' business activities and performance. We conduct social network analysis on the combined datasets and utilize panel fixed effect estimation to analyze the longitudinal datasets of network structural measurements from 2010 to 2021. This empirical study enriches social network analysis literature by addressing the challenges in predicting the ties of firms' networks using an individual social network. Further, our findings provide theoretical insights into the knowledge diffusion pattern in technology innovation and offer practical suggestions for firms to maintain a competitive advantage by being alert to the future direction of technology innovation of peer firms.

Title: Analysis of physiological signals for exoskeleton control

Primary Author: Sierra Eady

Additional Authors: Michael Zabala;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Exoskeletons are wearable assistive devices that augment human motion. The Auburn University Biomechanical Engineering Lab in the Department of Mechanical Engineering has recently completed a multi-year project with U.S. Army Combat Capabilities Development Command and Aptima, Inc. developing exoskeleton control algorithms for an ankle exoskeleton. Efforts to include electromyography (EMG) into exoskeleton control algorithms have been minimally successful. It is possible that using changes in EMG signal characteristics and/or electromechanical delay (EMD) (EMG onset time subtracted from force onset time) could improve the efficacy of EMG for this purpose. In order to accurately assess the utility of the EMG signal characteristics and EMD for exoskeleton control, the signal must be evaluated under multiple conditions that a wearer may encounter such a high stress environment. The designed study will evaluate the antagonistic muscle pair at the ankle – the gastrocnemius and the tibialis anterior –under three conditions: stress, fatigue, and variable desired force output. One Delsys surface EMG sensor will be placed on each muscle, and an FSR array will be placed on the proximal phalanges of the foot. For each muscle, the test participant will perform maximum voluntary contractions (MVC) followed by three isometric contractions under each of the three conditions. It is hypothesized that EMD will lengthen as the muscles fatigue, shorten after stress has been induced, and that there will be no difference between different attempted effort levels. It is also hypothesized that EMG amplitude will decrease as the muscles fatigue, increase after stress has been induced, and increase for higher attempted effort levels. Lastly, it is hypothesized that EMG frequency will decrease as the muscles fatigue, increase after stress has been induced, and increase for higher attempted effort levels.

Title: Novel Pan RAS inhibitor ADT-007 demonstrates antitumor activity in models of lung adenocarcinoma by disrupting oncogenic signaling.

Primary Author: Sindhu Ramesh

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

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Mutations in RAS genes occur in 30 percent of patients with lung cancer and are major oncogenic drivers of tobacco-induced lung cancer. RAS mutations encode for abnormally activated RAS proteins KRAS, NRAS, or HRAS that are predominantly in the active state thereby promoting tumor cell proliferation. As RAS becomes activated in the initial phases of lung cancer, the potential effectiveness of a selective and potent inhibitor targeting activated RAS is highly promising for preventing or treating lung cancer at its early stages. Currently approved covalent inhibitors targeting the KRAS G12C mutation have shown promising tolerability and anticancer activity. However, these inhibitors require a reactive cysteine residue for inhibition and cannot be used against non-G12C mutants, which constitute most KRAS alterations in cancer. To address these issues, we developed a novel series of pan RAS inhibitors with high potency and selectivity to inhibit the growth of tumor cells with highly activated RAS resulting from mutations or activation of the upstream signaling network. A lead compound from this family, ADT-007 binds RAS in a nucleotide-free transitional state to reduce the rate of GTP binding to RAS, thus interfering with RAS activation and suppressing MAPK and AKT signaling. ADT-007 effectively suppresses the proliferation of cultured human and murine cancer cell lines, demonstrating low IC50 values and inhibiting KRAS-MAPK/AKT signaling in human and mouse lung adenocarcinoma cell lines. These data support future preclinical validation and development as a promising potential treatment for patients with lung cancer regardless of the underlying mutation.

Title: An analysis on how music affects tourism in Asheville North Carolina

Primary Author: Sion Brunson

Additional Authors:

Department/Program: Geology and Geography

College: College of Sciences and Mathematics

Abstract: Music plays a significant part in how a visitor develops their sense of place in a destination and can contribute to that place's tourism. While studies have been done on large-sized cities that are known for music, few were done on mid-sized ones. Asheville, a mid-sized city, has grown into an eclectic scene for entertainment with multiple music venues promoted online. Using Asheville as a study area, this study looks at if and how music is promoted in Asheville's tourism message. Using discourse analysis from bottom-up coding, I analyzed interpretive text and images from Asheville's guidebooks to create themes that make up the city's overall tourism message. Three broad concepts were developed from these themes, nature-based tourism, cultural heritage, and cosmopolitan city. Within these concepts, music is shown as a crucial part of Asheville's tourism message when it comes to promoting shows, venues, and festivals that attract visitors. By applying discourse analysis using guidebooks, geographers could develop a greater understanding of how music helps contribute to tourism promotion for mid-sized cities.

Title: Virulence of fungal isolates of Beauveria bassiana and Beauveria brongniartii against multiple insect hosts: A comparative study with nine isolates

Primary Author: Somraj Shrestha

Additional Authors: Jeffrey Coleman;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: The pervasive impact of insects on agriculture poses a formidable challenge. Recent estimates from the Food and Agriculture Organization (FAO, 2023) underscore the severity of the issue, indicating an alarming 20-40% crop loss, accounting for approximately $70 billion in economic losses globally. The use of chemical insecticides has adverse effects on the environment and insects develop resistance against them after several generations. *Beauveria* is an entomopathogenic fungus found naturally in soils and collectively can infect more than 700 insect species across different insect orders. Therefore, we can delve into harnessing *Beauveria* as a biopesticide to control insect pests. The purpose of this study is to evaluate the host range of individual isolates of *Beauveria* spp. to determine if host-specificity exists for this fungal pathogen. The fungus was evaluated through a dipping and leaf disk treatment assay to assess the virulence of *Beauveria* isolates across multiple insect hosts from different insect orders. Two isolates, ARSEF 1520 and ARSEF 3097, demonstrated superior virulence against Coleoptera (Mealworm), and isolate ARSEF 2597 exhibited the highest efficacy against lepidopteran insects (fall armyworm, cotton bollworm, and greater wax moths), with isolates ARSEF 1520 and ARSEF 3097 displaying notable performance. Overall, different isolates exhibited variation in virulence against a particular insect species. Some isolates like ARSEF 1520, ARSEF 2597, and ARSEF 3097 demonstrated efficacy against all the insect hosts tested, while other isolates such as ARSEF 2860, ARSEF 5078, and ARSEF 4305 had low virulence across all insect species. Based on this limited preliminary study, it appears some isolates are more virulent when compared to others suggesting *Beauveria* spp. do display host-specificity.

Title: Redefining hospitality operations through circular economy

Primary Author: Souji Gopalakrishna Pillai

Additional Authors: Imran Rahman;Furkan Kai Arasli;

Department/Program: Hospitality Management

College: College of Human Sciences

Abstract: The hospitality and tourism industry, crucial for global economies, confronts challenges concerning environmental impact and sustainability amidst directives such as the Paris Agreement advocating emission reductions. Circular economy principles (CEP) emerge as a promising framework to mitigate waste and optimize resource utilization. However, the factors driving and consequences of CEP adoption within hospitality operations remain insufficiently explored. This paper, guided by stakeholder theory, upper echelons theory, and institutional theory, aims to fill this gap by investigating stakeholder pressure (SP), institutional pressures (IP), and top management commitment to sustainability as drivers for CEP adoption. The study further examines the impact of CEP adoption on outcomes including sustainable-oriented innovation (SOI) and its influence on Sustainable Performance (SUP) in the hospitality sector. Data was collected from 173 respondents using an online survey from 23 green hotels in India representing diverse segments, which was conducted to comprehend their adoption of circular economy principles. Employing Partial Least Squares Structural Equation Modeling for data analysis, the study confirms significant positive relationships between SP and IP with top management sustainability commitment (TMSC), TMSC with CEP adoption, CEP adoption with SOI, and SOI with SUP. The findings reveal that the degree to which IP translates into positive environmental actions is heavily contingent on top management commitment. The mediating role of top management distinctly indicates that the leadership skills and vision of top management play a crucial role in influencing organizations' initiatives to adopt CEP. These findings contribute insights for industry practitioners and policymakers to nurture a more sustainable and competitive landscape within the hospitality sector.

Title: Generative AI and Immersive Technologies: Bridging the Gap in Personalized Mental Health Support

Primary Author: Soundarya Korlapati

Additional Authors:

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Generative Artificial Intelligence (Gen-AI) and Immersive Technologies (ImT) are advancing rapidly. They have tremendous potential to transform a variety of fields, including mental health. Gen-AI promises more realistic personal and virtual environments, while ImT promotes engaging therapeutic experiences. However, there is a significant research gap in integrating these technologies to create truly personalized and engaging mental health support. The mental health market is expected to reach $347.3 billion (US dollars) by 2027 and over 26%%20of adults in the US suffer from mental illness every year. Current methods often lack customization and immersion depth, which leads to treatment fatigue and reduced user engagement. This study fills this gap by proposing a new way to integrate Gen-AI and ImT. This study hypothesizes that (a) Gen-AI powered virtual companions can provide personalized medical support by adapting their behaviors and responses to individual needs and preferences, (b) through Gen-AI powered biofeedback within ImT environments allowing real-time emotional monitoring to be personalized Interventions based on the user's emotional state. This integrated approach addresses the growing need for an engaging and inclusive mental health system that can improve treatment adherence, reduce stigma, and increase access, especially for underserved populations.In the proposed research, the first step is to create personalized virtual partners using Gen-AI trained on specific clinical data and information. These partners are then integrated into an interventional immersive environment designed for specific therapeutic goals. Finally, clinical trials will be performed to evaluate the efficacy and user engagement of integrated interventions compared to traditional methods. The goal of this proposed research is that everyone can access simple, engaging, and effective mental health services.

Title: LLMs as On-demand Customizable Service

Primary Author: Souvika Sarkar

Additional Authors: Shubhra Kanti Karmaker Santu;

Department/Program: Computer Science and Software Engineering

College: Samuel Ginn College of Engineering

Abstract: Large Language Models (LLMs) have demonstrated remarkable language understanding and generation capabilities. However, training, deploying, and accessing these models pose notable challenges, including resource-intensive demands, extended training durations, and scalability issues. To address these issues, we introduce a hierarchical, distributed LLM architecture concept that aims to enhance the accessibility and deployability of LLMs across heterogeneous computing platforms, including general-purpose computers (e.g., laptops) and IoT-style devices (e.g., embedded systems). By introducing a “layered” approach, the proposed architecture enables on-demand accessibility to LLMs as a customizable service. This approach also ensures optimal trade-offs between the available computational resources and the user’s application needs. We envision that the concept of hierarchical LLM will empower extensive, crowd-sourced user bases to harness the capabilities of LLMs, thereby fostering advancements in AI technology in general.

Title: Crossover patterning mechanisms in Drosophila melanogaster meiosis: a maximum likelihood approach for a stochastic process along the chromosome axis

Primary Author: Spencer Koury

Additional Authors: Laurie Stevison;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: All sexually reproducing organisms undergo a specialized cell division (meiosis) to generate the gametes (eggs and sperm) that form the next generation of individuals. This conserved cellular process occurs so rapidly, and on such a small scale, that it is not directly observable in the vast majority of species. Nonetheless, scientists are able to infer the rate and distribution of meiotic events that occurred in parents' meiocytes by scoring the combination of genetic markers in their offspring. This type of analysis reveals the meiotic cellular machinery is immensely complex, under strong genetic control, sensitive to environmental perturbation, and operates as a stochastic spatial process. At Auburn University, the Stevison Lab uses the <<Drosophila melanogaster>> model system to study effects of both genetic and environmental factors on meiotic recombination. In a series of studies on temperature, atmospheric oxygen concentration, caloric density in diet, genome composition, and chromosomal rearrangements, all factors changed the frequency of observed recombinant offspring. However, the ways in which these factors alter the rates and distributions of meiotic crossing-over in the parents are less apparent. To address this question, I use a maximum likelihood approach to estimate parameters of both Poisson and renewal processes from experimental datasets. This analysis reveals both environmental stressors and genetic factors do not have uniform effects on crossover rates and alter the distribution of genetic exchange along the chromosome. Interestingly, meiotic responses under different perturbations suggest different causal pathways control changes in crossover patterning. The combination of experimental manipulation and mathematical modeling in <<Drosophila>>, and the meiosis field more generally, is proving to be a powerful approach to elucidating the crossover patterning mechanisms from flies to humans.

Title: Studying the effect of drought on peanut's stomatal characteristics: Development of an automatic detection method.

Primary Author: Spencer Rubin

Additional Authors: Alvaro Sanz Saez de Jauregui;Sajid Hanif;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Approximately 65 percent of peanuts in the U.S. are produced without irrigation due to their tolerance to short-term drought. However, the American Peanut Council has identified drought damage as the most serious challenge facing peanut sustainability in the U.S. Improved resistance to abiotic stress such as drought is crucial for the long-term viability of U.S. peanut production. Stomatal characteristics of stomatal density and size affect the overall plant transpiration efficiency and have been identified as possible drought tolerant characteristic. We expect to find smaller and less dense stomata on more drought tolerant cultivars allowing the plant to preserve more water during drought stress. Measuring stomata density and size is very time consuming because it requires that a person identifies them one by one and measures the size with an imaging software, while only observing one image at a time. In this project we are adapting an existing AI software (Label Stomata) that measures stomata characteristics in soybean, common bean, and grasses. With this proposal, we grew 5 peanut cultivars in the field under irrigated and drought conditions and sampled the leaves and took stomata prints with super glue. Once the samples were taken, images were acquired with an automatic light microscope. Those images were run through label stomata automatic detection software and recalibrated by hand to obtain a detection efficiency higher than 90 percent.

Title: Modelling of Energy Need for Cooling and Heating in Controlled Environment Agriculture based on Meteorological Data of Auburn, Alabama

Primary Author: Sudip Sapkota

Additional Authors: Sushil Adhikari;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: Increasing food production whilst reducing environmental deterioration is a critical step towards achieving a sustainable agriculture system. Achieving that with conventional open-field farming is challenging. Growing crops in controlled greenhouse structures is one of the ways to increase crop yield per unit area of land. However, the system relies on high-energy inputs, which can be minimized by properly investigating the energy flow of the system. In this study, a mathematical model is developed using the energy balance equation of the greenhouse to estimate the annual heating and cooling requirement and to determine various ways to reduce energy consumption. The meteorological data needed for the study was obtained from the National Solar Radiation Database, and the technical data on the greenhouse was obtained from the literature. The study site was selected in Auburn, Alabama, and it was found that cooling is mostly required from May to September, with a maximum requirement of 130 kWh/m2 for August. Whereas heating is mostly required from November to February, with a maximum requirement of 54kWh/m2 for January. The cooling energy need could be reduced by selecting covering material with lower transmittance while not limiting the biological processes of a plant. However, a greenhouse should be tightly sealed during the winter to prevent heat losses and decrease heating requirements. The result showed that the increase in the maximum temperature that a plant can withstand by 3 degrees Celsius can drastically reduce cooling energy requirement by about 24 percent. Thus, for greenhouse farming, it is important to select crops that can withstand a larger range of temperatures.

Title: Tetrahydrocurcumin: curcumin metabolite, exhibits neuroprotection and an effective prophylactic and therapeutic natural bioactive for neurodegenerative pathologies

Primary Author: Suhrud Pathak

Additional Authors: Timothy Moore;Muralikrishnan Dhanasekaran;Satyanarayana Pondugula;Surekha kadannagari;Keyi Liu; Courtney Alexander

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Due to its potent pharmacodynamic properties and minimal adverse effects, curcumin (*Curcuma longa*-turmeric) is one of the most beneficial natural products used globally. Curcumin has been used as a dietary supplement and nutraceutical prophylactically and therapeutically. Additionally, it has also been used for cosmetic purposes. On the other hand, curcumin's limited bioavailability has long been a barrier to its application in medicine. Therefore, the metabolites of curcumin have become a recent study topic, and extensive studies have been done to enhance curcumin usage. Furthermore, past and current data show that curcumin or curcuminoid metabolites have biological activity comparable to or better than its precursor. The current study focused on establishing the novel neuroprotective action of Tetrahydrocurcumin (a key curcumin metabolite). Both in-silico and *in vitro* studies were performed to elucidate and validate the neuroprotective effects and potential neuroprotective mechanisms of Tetrahydrocurcumin. HT-22 (hippocampal neurons) and N27 (dopaminergic neurons) were used to illustrate the impact of Tetrahydrocurcumin on hippocampal and dopaminergic neuronal viability. Moreover, oxidative stress markers, mitochondrial function, inflammation, and apoptosis were studied to investigate the neuroprotective mechanisms. Furthermore, RNA sequencing was performed to validate the neuroprotective effects. Tetrahydrocurcumin demonstrated significant neuroprotection on both neurons (hippocampal and dopaminergic). The neuroprotection was attributed to its antioxidant and anti-apoptotic actions. Thus, tetrahydrocurcumin can be an impactful therapeutic natural bioactive metabolite for preventing and reducing the rate of progression and treating neurodegenerative pathologies.

Title: Are cells expressing anti-mullerian hormone receptor type 2 (AMHR2) implicated in the sexual dimorphism observed in the adrenal gland?

Primary Author: Sujeong Kim

Additional Authors: Jeff Huang;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Adrenal gland diseases exhibit a higher prevalence in women compared to men, and genome-wide studies reveal sexual dimorphism in adrenal gland gene expression. The underlying mechanism of this dimorphism remains unclear but is hypothesized to be linked to the shared origin of the adrenal gland and gonads during development. The receptor for anti-Mullerian hormone (AMH), encoded by AMHR2, controls the differentiation of secondary sex organs. Mutations in AMH or AMHR2 result in Persistent Mullerian Duct Syndrome (PMDS), a condition where a biological male develops female sex organs. Although primarily expressed in sex organs, preliminary evidence from a pilot study suggests that AMHR2 cells contribute to adrenocortical cells. The ongoing research project utilizes a mouse model with double genetic modifications, expressing the diphtheria toxin subunit alpha gene (DTA) in AMHR2 cells, resulting in the elimination of all AMHR2 cells and their descendants. A comparative analysis of adrenal glands between double mutant mice and wild-type littermates aims to elucidate the role of AMHR2 cells in adrenal gland development.Initial results indicate small testes and ovaries in double mutant mice, highlighting the importance of AMHR2 cells in gonad development. However, despite the presence of AMHR2 cells in the adrenal gland, adrenal gland size remains unchanged. This finding is consistent with lineage tracing observations indicating that the adrenal gland cortex continuously renews its cell population. While preliminary data suggests no impact on adrenal gland size, ongoing research involves double immunostaining to assess potential effects on adrenal cortex zonation. Marker genes such as 3βHSD, β-catenin, CYP2F2, and tyrosine hydroxylase are used to identify specific cell types and zonation patterns. If AMHR2 cells play a crucial role, the expectation is a disorganized adrenal cortex in double mutant mice. This study offers valuable insights into the role of AMHR2 cells in adrenal gland development and may reveal connections to sexual dimorphism.

Title: Utilizing search engine data for two major US hurricanes to trace knowledge gaps in resiliency for improved community awareness

Primary Author: Sukanya Dasgupta

Additional Authors: Chandana Mitra;

Department/Program: Department of Geosciences

College: College of Sciences and Mathematics

Abstract: Due to the rising demand for ocean-front real estate, urbanization along United States (US) coastal regions is predicted to continue to accelerate in response to an increasing population. Coastal cities are experiencing increased environmental pressures and deterioration as a result of urbanization, which may have a detrimental effect on the systems that govern the interactions between land and water. In recent years, significant natural hazards such as hurricanes have become more common due to the changing climate and rapid landcover changes in the United States. Using data from NOAA's International Best Track Archive for Climate Stewardship (IBTrACS) and ArcGIS Pro, storm patterns, such as wind speeds and trajectory, can be recognized for over a period of 180 years (1842–present) to assess and quantify the physical damage and recovery post-hurricane. In partnership with this data from NOAA additional data can be obtained by utilizing search engine data through Google Trends. This allows for the ability to examine the keyword search patterns of residents in the area before, during, and after these events. With the help of these search patterns, the gaps in hurricane preparedness knowledge can be identified which will help to assist in the development of future suggestions for community resilience. This case study will analyze and compare historical hurricane information trends and patterns, for two mega-hurricanes Hurricanes Irma (2017) and Ian (2022) specifically focusing on one region in Florida (Fort Myers-Naples area). This area was chosen because it represents a small to medium sized city and has been identified as a high hurricane prone zone by the IBTrACS. Ultimately, the goal is to help to improve hurricane-prone regions' abilities to make their residents more hurricane aware and more resilient to these events in the future.

Title: Navigating academia in the age of AI: a comprehensive exploration of college students' perceptions and impacts of ChatGPT across liberal arts and STEM majors

Primary Author: Sumin Kang

Additional Authors: Jonghyun Jung;

Department/Program: Business Analytics and Info Systems

College: Harbert College of Business

Abstract: The development of Artificial Intelligence (AI) has advanced rapidly in recent years. AI systems learn by absorbing huge amounts of data and analyzing the data to generate lifelike responses according to the user's inquiry. Although AI is considered a new and advanced technology, the rise of ChatGPT surprised the world due to its efficiency and customizable experience. ChatGPT, released in late 2022 by OpenAI, is a generative AI that utilizes data using Natural Language Processing. ChatGPT has become the subject of debate within the educational sector concerning academic achievements, including academic honesty, and critical thinking skills. As that reason, educators in higher education strongly assert understanding the purpose, and the necessity of knowing the proper use of ChatGPT in education settings as education is crucial in society. This study aims to examine how college students, specifically those in liberal arts and STEM majors, perceive the use of ChatGPT in an academic environment and its impact on their academic achievement. Research Question 1: How do college students in liberal arts and STEM majors perceive the use of ChatGPT in an academic environment? Research Question 2: How does the use of ChatGPT influence the various dimensions of academic achievement among college students, specifically looking at GPA, test scores, assignment quality, and the development of critical thinking skills. This study will utilize Focus Group Interviews as the primary qualitative research method, targeting college students from liberal arts and STEM majors. The choice of FGI is to get data from interactions and discussions among participants. This approach is particularly effective for researching complex topics like the use of AI tools in education. The outcomes of this research will have realistic and conspicuous effects on the study habits and learning strategies of using ChatGPT for college students, and it can provide practical implications.

Title: Impact of government grants and subsidies on the living standard of households in South Africa

Primary Author: Susan Osayande

Additional Authors: Kate Thornton;Taneshia West Albert;

Department/Program: Global Education

College: College of Human Sciences

Abstract: Efforts to alleviate poverty and reduce inequality in Sub-Saharan Africa face challenges amid increasing governmental receipt of foreign aid. After the end of the apartheid regime in South Africa, the new democratic government implemented various social support strategies to tackle poverty and improve household living conditions. However, limited research has examined the long-term effectiveness of these strategies. Methods: This study utilizes three waves of longitudinal data from the National Income Dynamics Study (NIDS), spanning from 2012 to 2017 to investigate the impact of different government grants and subsidies on household living standards in South Africa. Results: Preliminary findings suggest that government grants, housing subsidy, land grants and restitution were significant predictors of improved living conditions in wave 3 (2012). However, by wave 4 (2014 – 2015), government grant was no longer a predictor for improved living conditions and by wave 5 (2017), government grants, housing subsidy, land grants and restitution showed no significant impact on household living condition. Discussion: While initial analysis revealed significant associations between the different government grants and improved living conditions, subsequent waves of data highlighted diminishing effectiveness of government interventions over time. This study contributes to the ongoing debate on poverty alleviation strategies in Sub-Saharan Africa, providing insights for policymakers and stakeholders to design more effective interventions to enhance living standards of vulnerable populations.

Title: Structural and mechanistic studies of an integral membrane desaturase

Primary Author: Susan Short

Additional Authors: Rahul Banerjee;

Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Stearoyl CoA desaturase (SCD), a nonheme diiron enzyme, has been implicated in many adverse human health conditions such as cancer cell proliferation and viral replication among many others. SCD catalyzes the Δ9 desaturation of coenzyme A (CoA) linked fatty acids using molecular oxygen to make monounsaturated fatty acids. Its novel active site carries the potential for an unprecedented mechanism of oxygen activation. Previous work on this integral membrane protein has resulted in structural and mechanistic data based on predominantly inactive enzymes. It is believed that enzyme activity is lost as a result of the use of detergents which lead to the stripping of native membrane phospholipids and the loss of labile iron from the active site. Recent advancements in membrane protein techniques have offered new detergent-free alternatives for the purpose of maintaining native phospholipid structure which could contribute to integral membrane protein structure and function. Here, we present the early stages of a new approach to characterizing SCD in its native membrane environment. Future work will apply detergent-free alternatives to maintain native structure and subsequent enzyme activity for downstream characterization of SCD structure and mechanism.

Title: A comparative analysis of multispectral and lidar UAV-imagery for identifying pine trees infected with brown spot needle blight

Primary Author: SWATI SINGH

Additional Authors: Lana Narine;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Pine forests in the Southeastern United States face a significant threat from Brown Spot Needle Blight (BSNB), a disease impacting needle foliage. The potential consequences for the region's economy are substantial. Traditional field methods for identifying infected trees are expensive, time-consuming, and labour-intensive, presenting challenges when monitoring extensive forest landscapes. Consequently, there is a necessity to utilize state-of-the-art remote sensing methods, especially unmanned aerial vehicles (UAVs) technologies. The proliferation of UAVs over the past decade can be attributed to technological advancements, particularly in sensor technologies. This study aims to compare the effectiveness of UAV-multispectral and light detection and ranging (lidar)-derived products in detecting individual trees infected with BSNB disease. We present a comparative framework using UAV-multispectral and high-density UAV-based lidar data, incorporating canopy height model (CHM) development and individual tree detection (ITD) methods. The accuracy assessment is grounded in manual interpretation from high-resolution imagery and field data. The findings demonstrate a strong correlation between the multispectral and lidar-derived measurements. The results highlight a cost-effective approach for BSNB detection, providing an efficient, user-friendly, and time-saving computational solution.

Title: Enhanced anticancer efficacy of topotecan and pioglitazone combination therapy in prostate cancer treatment

Primary Author: Sydney Hamilton

Additional Authors: Robert Rusty Arnold;Rajesh Amin;Amit Mitra;Mary Cate McCormick;Sarah Batten;Lani Jasper;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: Prostate cancer is a leading cause of cancer-related morbidity and mortality among men in the United States. Although numerous advances have been made in treatment options, there remains a need for more effective treatment options for advanced-stage disease. This study investigated the potential synergistic effects of combining pioglitazone, a PPAR-γ agonist with topotecan, a topoisomerase inhibitor, in the treatment of prostate cancer. We determined the effects of topotecan paired with pioglitazone on cell viability in PC-3, PC-3M, PC-PXR, and MDA-PCa-2b cell lines. The results demonstrated that the combination of pioglitazone and topotecan exhibited greater inhibition than either drug alone. These findings highlight the potential for combining topotecan with PPAR-γ agonists such as pioglitazone as a therapeutic strategy for the treatment of prostate cancer. Future studies will validate these findings and explore the use of novel PPAR-γ agonists.

Title: Impact of messaging on veterinarians' willingness to implement means safety protocols

Primary Author: Sydney Waitz-Kudla

Additional Authors: Tracy Witte; Hailey Fox; Andy Roark; Indu Mani

Department/Program: Psychology

College: College of Liberal Arts

Abstract: Veterinarians exhibit an increased suicide risk compared to the general population. This increased risk may be due to veterinarians' knowledge and access to pentobarbital, a drug used for euthanasia that is often used by veterinarians as a means for suicide. One possible way to reduce suicide risk for veterinarians is through means safety or creating barriers between suicidal individuals and lethal means. Research has shown that storing pentobarbital in a separate lockbox is an acceptable and feasible means safety protocol for veterinarians. Additional research is necessary to investigate the most effective way to advertise this means safety protocol to veterinarians. The current experiment investigates how messaging influences veterinarians' willingness to implement an extra lockbox as a means safety protocol and the most acceptable way to present this information. We randomized veterinarians to view graphics across two levels of two different messaging factors: DEA regulations versus empirical data supporting means safety and reducing participants' own suicide risk versus their coworkers'. Data has been collected (N=443) and will be analyzed by March 1, 2024. We will examine how each factor influences veterinarians' willingness to add a separate lockbox for pentobarbital, and which level of each factor is reported as most acceptable. We hypothesized that empirical data will be rated as more acceptable and will result in a greater increase in willingness to implement than DEA regulations. We also hypothesized that coworker suicide risk will be rated as more acceptable and will result in a greater increase in willingness to implement than own suicide risk. We additionally hypothesized that the combination of empirical data and coworker suicide risk will result in the greatest increase in willingness and will be most acceptable across factor combinations. This study will continue building the foundation for means safety interventions in the veterinary population.

Title: Using sorbitol as an eco-friendly additive to prevent cracking in sheared cellulose nanocrystal films.

Primary Author: Tanmay Rahman

Additional Authors: Virginia Davis;Saim Siddiqui;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Cellulose nanocrystals (CNCs) are naturally occurring nanomaterials prized for their liquid phase processibility, tuneable surface chemistry, and exceptional mechanical properties. However, the inherent rigidity of CNCs often leads to the development of cracks and curls in aligned CNC films. Previous approaches to address this issue have involved the use of polymers such as poly (vinyl alcohol) (PVA), polyols, and polyethylene glycol (PEG). However, these additives frequently compromise the alignment and mechanical properties of CNC films. In contrast, small molecular weight eco-friendly additives like glycerol and sorbitol have shown promise in mitigating film defects in drop-cast CNC films. However, the effects of sorbitol on the CNC dispersion flow behavior, microstructure, and shear-cast CNC films have not been thoroughly explored. This study investigated the impact of sorbitol concentration on CNC dispersion microstructure and rheological properties, as well as the mechanical, optical, and thermal characteristics of shear-cast CNC films. Cross-polarized optical microscopy was used to analyze sorbitol's effects on the microstructure of aqueous CNC dispersion. Steady shear and small amplitude oscillatory shear rheology provided additional insights into changes in dispersion microstructure and shear response. Low levels of sorbitol addition was found not to hinder the formation of CNCs' cholesteric liquid crystal phase, although some alterations in pitch were observed. After shear casting and drying, the alignment of CNCs within the films was quantified using optical contrast measurements and mechanical property assessments in parallel and perpendicular directions. In addition, thermal gravimetric analysis (TGA) was utilized to evaluate whether there were differences in the films' thermal stability and moisture content. These results showed that sorbitol is a promising additive for mitigating film cracking while preserving CNC films exceptional properties.

Title: Implementing Camp-based Education to Increase Childhood Asthma Knowledge

Primary Author: Taylor Murphy

Additional Authors: Chih-hsuan Wang;Linda Gibson-Young;

Department/Program: Nursing

College: College of Nursing

Abstract: Childhood asthma is the most common chronic childhood condition in the United States, affecting 8.6 percent of children. Despite its prevalence, asthma is a critically misunderstood disease and requires exploration with social determinants of health. Researchers have examined the relationship of socioeconomic status, health literacy, and asthma knowledge with home management of childhood asthma. Our study examines how community interventions addressing such variables with asthma control. Asthma Camp Eagle is a 4-day, 3-night camp in Alexander City, AL designed to educate children 7-12 years of age with asthma. This proposal explores relationships with SES, knowledge, and literacy in children and families attending camp over the past 4 years. Methods: We implemented a camp intervention for children 7-12 years of age currently living with asthma over a 4-year period. Data examined between parent-child dyads and individually for outcomes. Results: We had 55 unique campers and 32 returning campers. The ages of campers (7-12), mild to severe severity of asthma(33 percent of children moderate persistent, 64 percent mild persistent, 3 percent severe persistent), and child perception vs. parent dyads (matched and no relationship between outcomes). Data are being explored at a detailed level. Conclusion: Asthma outcomes continue to decline in children living with moderate to severe persistent asthma. Community interventions need to do a better job with data collection and exploration. Camps connected with Auburn University offer opportunities to engage with children and parents impacted by asthma.

Title: Using genetic variants and evolutionary history of the fungal pathogen Lecanosticta acicola to understand needle blight

Primary Author: Temitope Ruth Folorunso

Additional Authors: Lori Eckhardt;Janna Willoughby;

Department/Program: Forestry and Wildlife Services

College: College of Forestry, Wildlife and Environment

Abstract: Lecanosticta acicola is a fungal pathogen that causes Brown Spot Needle Blight (BSNB). Although some species are capable of overcoming BSNB infection generally through a prescribed fire treatment, growth and survival of loblolly pines (Pinus taeda) infected with BSNB is typically reduced because loblolly pine saplings do not tolerate the fire treatments. In the southeast US, loblolly pine is a main source of timber and a multibillion dollar industry. Thus, there is a need to ensure continued viability and maximum production of loblolly by managing L. acicola. Needles were sampled twice a month from loblolly pine, longleaf pine and splash majorly in the North and South of Alabama for brown spot detection and genetic variation studies. Culturing of the fungus was done in the laboratory on 2%%20Malt Extract Agar this a yielded considerable amount of mycelium compared to other media. We detected that other fast-growing fungi occupied the media other than the target pathogen this means it is a slow growing fungi. We have identified the fungal pathogen morphologically and confirmed molecularly using species specific primers after DNA extraction in almost all of our sampled sites. These results confirmed rapid invasion of this pathogen in pine plantations across Alabama and needs quick intervention to mitigate it's spread. Going forward in this work, we will sequence the genome of L. acicola to obtain long read data in order to examine patterns of genetic variants among all cultured isolates to understand how this fungal pathogen moves across the landscape. We will also consider fungal biomass in each needle sample in all the sampled regions to determine how plants respond to fungal infections. These projects all aim to provide information about the molecular interactions that exist in this host-parasite system to provide insights into control of this fungal pathogen.

Title: Determining the role of gut microbiota in the production of ROS by cockroach hemocytes

Primary Author: Tessa Allen

Additional Authors: Elizabeth Schwartz;Faith Boyer;

Department/Program: Biological Sciences

College: College of Sciences and Mathematics

Abstract: The impact of the gut microbiota on the development and function of the host immune system has been assessed in mammalian systems using germ-free and gnotobiotic animals, primarily mice. However, this relationship remains incompletely defined in insects. The American cockroach (Periplaneta americana) has a relatively complex gut microbiome compared to other insects and is an excellent model for such studies. With the recent development and optimization of germ-free protocols for the American cockroach, this system now provides a unique opportunity to investigate the interaction of the gut microbiome and the innate immune system. Insect immune cells, called hemocytes, have been characterized primarily through microscopy, leaving a knowledge gap regarding the specific functions and relative abundance of different hemocyte subsets. To first address this knowledge gap and better characterize the immune cells of the cockroach, we have employed flow cytometry and functional assays. With these approaches we can isolate and identify hemocyte subsets based on lectin-binding capabilities and their specific functions (I.e., production of reactive oxygen species). Our studies demonstrate that a subset of granular hemocytes from conventional cockroaches produce ROS when stimulated with LPS with activity peaking within one hour of stimulation. We will additionally utilize cell sorting and microscopy to gain a fuller understanding of hemocyte morphology and individual functionality. These studies will serve as foundational knowledge for future studies, providing the necessary baseline immunological characterization in conventional P. americana for comparison to germ-free P. americana. This comparison will provide unique insight into the role of the gut microbiome in host immunological development and function.

Title: Development of Immunotherapies for Osteosarcoma

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 aggressive and metastatic bone malignancy with a low survival rate and poor patient prognosis. In recent years, immunotherapies, such as chimeric antigen (CAR) T cells and conditionally replicative Adenoviruses (CRAds), have shown promise in treating various cancers. We have developed and characterized a next-generation conditionally replicative canine adenovirus CAV2-AU-M2 armed with anti-PD1 sdAb. The infectious and cytolytic effects of CAV2-AU-M2 were tested in four different canine OS cell lines in 2-dimensional (2D) and three-dimensional (3D) cell cultures. CAV2-AU-M2 showed selective replication in OS cells and induced efficient tumor cell lysis. Moreover, CAV2-AU-M2 produced anti-PD-1 sdAb that demonstrated effective binding to PD-1 receptors. This combination approach of two distinct immunotherapies is intended to stimulate and enhance the anti-tumor immune response in the tumor microenvironment. We also aim to develop CAR T cells targeting the cancer-specific B7H3 receptor. The cytotoxic effects of anti-B7H3 CAR T cells will be tested in 2-dimensional (2D) and three-dimensional (3D) cell cultures. We expect cell lysis only in B7H3-positive cell lines. We will also assay the immunogenic effects of CAR T cells by analyzing IFNγ, TNFα, and IL-2 cytokine levels in OS cell lines post-CAR T therapy.

Title: CAR T immunotherapy as a treatment for canine osteosarcoma

Primary Author: Timothy Eller

Additional Authors: Payal Agarwal;Terri Higgins;

Department/Program: Entomology and Plant Pathology

College: College of Agriculture

Abstract: Osteosarcoma (OS) is a malignant bone tumor, occurring most often in the long bones of children and adolescents. It accounts for 3-5% of pediatric cancer cases. Osteosarcoma has a high tendency for pulmonary metastasis and poor prognosis. Current treatments involve preoperative chemotherapy and surgery, but survival rates have plateaued. Therefore, we need to develop novel therapies to target osteosarcoma. Cancer immunotherapies enhance the immune response in the tumor microenvironment (TME) and have great potential for osteosarcoma treatment. CAR T cell immunotherapy is the reinforcement of cytotoxic T cells against cancer cells. These cells are designed to express receptors against specific tumor surface antigens and have shown promise in liquid cancers; however, research on CAR T cells in solid tumors, like osteosarcoma, is limited. To evaluate the potential therapeutic effect of CAR T cells against OS, we are developing CAR T cells targeted against B7H3. B7H3 is a well-known tumor-specific cell surface ligand. T cells will be activated and expanded from the dog's PBMCs (peripheral mononuclear blood cells) and genetically modified to produce an anti-B7H3 receptor using lentivirus. Once CAR T cells are engineered, they will be assayed for cytolytic activity in 2D and 3D cultures of canine osteosarcoma cell lines. To quantify the effect of anti-B7H3 CAR T cells on OS cells, we have modified four canine osteosarcoma cell lines to express GFP and firefly luciferase (GFP/ffluc). We are modifying all four GFP/ffluc cell lines further to knock out the B7H3 protein using CRISPR-Cas9 for use as a negative control. Cytotoxicity post-CAR T treatment will be assessed through visual confirmation of GFP expression and luciferase cell viability assay. Our research will help validate CAR T cells as a viable form of treatment for osteosarcoma.

Title: Deciphering dystrophin's biomechanical properties: advancing the quest for DMD therapeutics

Primary Author: Toby Sizemore

Additional Authors: Priscila da Silva Figueiredo Celestino Gomes;Diego Barreto Gomes;Rafael Bernardi;

Department/Program: Physics

College: College of Sciences and Mathematics

Abstract: Duchenne Muscular Dystrophy (DMD) is a degenerative neuromuscular disease that affects every 1 in 3,500 males born. The fatal dystrophinopathy has an average life expectancy in the 20-30 year range, with most individuals losing the ability to walk around age 12. The disease is a result of a mutation on the dystrophin gene, which leads to a mutated form of dystrophin. Dystrophin is a large biomechanical protein that plays a complex role in stabilizing muscle cells and maintaining cellular integrity. Understanding the biomechanical properties of dystrophin is critical to developing treatments for those with DMD. While the protein has 4 regions, the central rod domain serves to be the relevant region as previous literature has demonstrated its functionality in the phenotypic expression of the dystrophinopathy. The purpose of this project was to investigate the biomechanical properties of the central rod domain, as well as the entire protein structure through the use of Steered Molecular Dynamic Simulations (SMD). The central rod domain contains 24 spectrin-like repeat (SR) regions that can be divided into 4 fragments: SR01-05, SR06-10, SR11-17, and SR18-24. High resolution structural data of these regions and the entire protein were obtained through the use of AlphaFold2 and MODELLER. Using NAMD, each of the regions and the entire protein structure were equilibrated. Steered Molecular Dynamic Simulations of each region were then run and data was obtained. Due to the system size of the entire structure of dystrophin of approximately 21.3 million atoms, residue-based coarse grained simulations employing a hydrophobic and polar pseudo-atom approach were run and relevant biophysical data was obtained.

Title: Translating Time across species: cats as a useful model system for aging

Primary Author: Toni Lee

Additional Authors: Christine Charvet;Madi Bryant;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Alzheimer's disease (AD) is an age-related neurodegenerative disease characterized by brain atrophy, plaques, and tangles, as well as dementia. Progress in characterizing AD and other age-related disorders is hindered by a dearth of animal systems that spontaneously develop AD-related pathologies found in humans. Cats are of particular interest because they possess brain plaques and tangles at late stages of life. The Translating Time dataset utilized corresponding time points to identify equivalent ages across species, relying on temporal variation in behavioral milestones and disease progression (e.g., age of onset of plaques and tangles). It encompasses 922 time points collected across 25 mammals, including 9 primate species, 6 rodent species, and 2 carnivore species. One major finding from this work is that it is difficult to find corresponding ages for humans at late stages of life (60s-70s) compared to great apes. Interestingly, a quadratic regression across time points expressed as the log-transformed age in days after conception equates corresponding ages across the lifespans of cats and humans. Accordingly, cats in their early teens equate to humans in their 60s, and cats in their mid-teens equate to humans in their 70s. The identification of corresponding ages across the lifespan in cats and humans demonstrates that cats are a well-suited model system to study aging.

Title: Connecting Plant Root Architecture and Water Transport Abilities Using a Transparent Soil

Primary Author: Tori Phillips

Additional Authors: Jean-Francois Louf;

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Plant roots can move water through various locations in the soil. Farmers empirically know that combining different plant species in the same crop sometimes results in higher yields for both species. While there are active research efforts to investigate the best species to grow together, there is not a deep understanding of how and why these species benefit from each other. To answer these questions, we designed a transparent soil made of hydrogel spheres which enables us to directly visualize underground plant water motion. We used soy to investigate the relationship between root architecture (depth, diameter, width), xylem (water transport channels) size, and soil porosity and hydration to plant hydraulic transport abilities. Our goal is to develop a physical model for water transport from soil to plant back to the soil for different species at various stages of their development. Our study should provide a contextual understanding of plant water transport in soil, potentially helping farmers to improve mixed crop strategies for higher yields in a specific environment.

Title: Influence of rainfall timing on the efficacy of hexazinone and quinclorac for the control of knotroot foxtail *Setaria parviflora*

Primary Author: Tunde Akanbi

Additional Authors: David Russell;Forrest Davis;

Department/Program: Crop Soil and Environmental Sciences

College: College of Agriculture

Abstract: Knotroot foxtail is a perennial grass found in pastures across the Southeastern US. For grazing livestock, young plants maintain desirable forage and grazing potential, however, prolific seed production and poor forage quality at maturity underscores this species' weedy nature. Herbicide active ingredients hexazinone and quinclorac have shown efficacy in controlling this weed, but their performance is influenced by soil moisture and rainfall activation. Knowledge of proper application before rainfall is essential for maximizing control and to manage for desirable forage species such as bermudagrass, bahiagrass, and tall fescue. Therefore, research was conducted in a controlled greenhouse at Auburn University to evaluate the response of knotroot foxtail to these herbicides under varied rainfall timings. Knotroot foxtail rhizomes were transplanted into pots and allowed to grow until foliage reached an average height of 28cm before being treated with 0.42 kg/ha quinclorac and 0.85 kg/A hexazinone herbicide. Overhead irrigation was calibrated to simulate 0.25 inches of rainfall 0, 3, 6, 9, 12, and 15 days after herbicide treatment. Injury was visually estimated at 7, 14 and 51 DAT and dry weight biomass of rhizomes were recorded at 51 days after each rainfall event. Collected data were analyzed using ANOVA and the means were separated using Tukey HSD Test. This preliminary study revealed that herbicide selection was a significant factor affecting rhizome biomass of knotroot foxtail. Plants treated with hexazinone had less rhizome dry weight compared to quinclorac at 51 DAT. Impact of irrigation timing on knotroot foxtail varied with respect to plant injury and no significant differences were observed at 51 DAT. The data suggest potential drought or transplant tress on plants which may have influenced their response to treatments. Further studies will be conducted to ascertain the optimal time required for rainfall to activate these herbicides for better control of knotroot foxtail. Additional efforts will also be undertaken to control other environmental factors.

Title: Can family influence the consumption of sustainable fashion?

Primary Author: Ummey Hani Barsha

Additional Authors: Yee Ming Lee;

Department/Program: Consumer and Design Sciences

College: College of Human Sciences

Abstract: Sustainability in the textile and fashion industry has become popular over the decade, prompting researchers to identify the key drivers and barriers to adopting sustainable fashion consumption as well as factors that shape consumers' purchase decisions. The family has been proven to be the strongest source of influence on consumer behavior, but its influence on sustainable fashion consumption remains under-researched. Therefore, this study aims to investigate the influence of familial elements in driving sustainable fashion consumption using an explanatory sequential mixed method. An online survey will be distributed through Prolific, an online market research company, to recruit 300-350 participants of 18-35 years who lived a minimum of 17 years in a family home and have ongoing contact with at least one of their family members. The survey instrument will include 5-point Likert-type questions related to families' normative influence, families' subjective sustainable consumption knowledge, families' sustainable product involvement, individuals' fashion involvement, and individuals' willingness to be involved in sustainable fashion consumption. The next phase of this study will involve a Zoom interview with 30 participants, who indicate their willingness to participate in a follow-up study to identify other familial issues that may impact sustainable fashion consumption. SPSS software (v.27) will be used to analyze the quantitative data. The demographics of the sample will be calculated using descriptive statistics, and multiple linear regression will be conducted to test the relationships between variables. ATLAS will be used to code the qualitative data and to identify the emerging themes and sub-themes. The result of this study is expected to reveal how the roles of families can be leveraged to cultivate sustainable mindsets and foster sustainable practices among younger generations.

Title: Role of surface chemistry and defects in maintaining MXenes stability in water

Primary Author: Valentina Nesterova

Additional Authors: Konstantin Klyukin;Ana-Maria Stratulat;

Department/Program: Materials Engineering

College: Samuel Ginn College of Engineering

Abstract: MXenes, an extensive group of 2D transition metal carbides and nitrides, exhibit remarkable electrochemical performance. However, the stability of MXenes remains a concern because of their fast degradation in water or air under ambient conditions. In present work, we used *ab initio* molecular dynamics (AIMD) simulations to resolve the atomistic mechanism of degradation of Ti3C2-MXenes in water and unveil the role of surface chemistry (Tx = O, OH, F) on their stability. Employing enhanced free-energy sampling AIMD simulations, we assessed the energy landscape of Ti dissolution for various surface chemistries. Further, we introduced defects, such as Ti vacancies, impurities, alkali metals, to the Ti3C2-MXene surfaces and examined their impact on the stability.

Title: Role of the Ventral Medial Midbrain/Pons in Sleep and the Effect on Behavior

Primary Author: Vander LeKites

Additional Authors: Daniel Kroeger;Henry Limbo;Julia Peterson;Natasha Wendy Grabau;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Sleep is important for many bodily functions, but the underlying neural circuits regulating sleep/wake states are still poorly understood. A recent study by Takata and co-workers (2018) identified the Ventral Medial Midbrain/Pons (VMP) as a potential candidate area containing sleep-promoting neurons. Specifically, GABAergic neurons (VGAT) in the VMP work to promote sleep. Whether activation of VGAT neurons induces restorative sleep or simply increases the quantity of sleep such as current pharmaceutical aids is unknown. We therefore used chemogenetics to specifically activate VGAT neurons in the VMP and performed an in-depth analysis of sleep-wake parameters. In our study, we employed an adeno-associated virus (AAV) to transfect VGAT neurons of the VMP in VGAT-cre transgenic mice to express the hM3Dq receptor in these neurons. We then activated the hM3Dq receptor with its ligand, Clozapine-N-Oxide (CNO), in varying concentrations (0.1, 0.3, 0.9 and 2.7 mg/kg) and recorded EEG/EMG signals for subsequent analysis of the quality and quantity of sleep. Specifically, we analyzed rapid eye-movement (REM sleep), non-REM (NREM) sleep and wakefulness. We show that CNO administration, but not saline administration, causes an increase in c-Fos expression, a marker of recent neuronal activation, in VGAT neurons in the VMP, suggesting that chemogenetic stimulation activates these neurons. Importantly, we find that administration of CNO (2.7 mg/kg) increases NREM sleep by >100%%20as compared to saline administration during the first 4 hours. However, REM sleep is not increased during the same period.

Title: Application of fuzzy logic cognitive modeling to integrate socio-ecological knowledge for carnivore conflict management

Primary Author: VASAVI PRAKASH

Additional Authors: Christopher Lepczyk;Robert Gitzen;

Department/Program: Administration Forestry and Wildlife Sciences

College: College of Forestry, Wildlife and Environment

Abstract: Human-carnivore conflict (HCC) is a global problem that is increasing due to overlap of carnivores ranges in human dominated landscapes. A fundamental challenge in HCC is that it almost universally involves human-human conflict. Local actors suffering the consequences of HCC may also lack power and money to develop and implement solutions, while conservation practitioners with power to guide solutions may be much more focused on species conservation. Considering this existing need of evaluating the HCC in a more holistic way encompassing various dimensions of this complex issue, we aim to use the systems thinking approach to incorporate theoretical frameworks to tease out the hidden aspects of HCC. In this study we use participatory fuzzy logic cognitive modeling approach to create mental models as a socio-ecological tool to study HCC. The theoretical lens of systems thinking, conflict theory, and power sharing help to elicit the similarities and differences between conservation managers and local actors. The system of human-tiger conflict in India is used as a model, for the effective tiger conservation and various human dimensions involved in this system. We conducted focused group discussions in 16 villages around Pilibhit Tiger Reserve to create mental models. 25 mental models were created, with 445 qualitative variables, aggregated across 6 themes – environmental and ecological dynamics, impacts on humans, community well-being, human landscape dynamics, management of protected areas, and mitigation efforts. Results show that conservation managers and local actors have similarities in understanding the complexity of tiger conflicts from the systems thinking perspective. However, based on conflict theory and power asymmetry, these two groups diverge in their needs and identification of mitigation solutions. These results are valuable for attending to unaddressed needs and consequences of conflicts to promote local backing of conservation initiatives and promote survival of wild species.

Title: Assessing the Impact of Temperature Fluctuation During Transportation on Chicken Breast Meat Shelf Life, Utilizing Bacterial Count and Electronic Nose for Rapid Detection of Spoilage Following Simulated Cold Chain Disruption.

Primary Author: Vianca Maite Tashiguano Encalada

Additional Authors: Amit Morey;Sungeun Cho;Laura Garner;Jaroslav Valenta;Luis Jose Guzman Sabillon;Sofia Sierra Melendrez;

Department/Program: Poultry Science

College: College of Agriculture

Abstract: Disruptions in the cold chain at different stages of the raw poultry supply chain have an adverse impact on the shelf life of the product, resulting in food wastage. Traditional spoilage studies use standard microbiological techniques; however, novel non-invasive technology called electronic nose emerges as an alternative option to estimate product spoilage status. Research was conducted to characterize and identify signature volatile compounds (VCs) from chicken meat exposed to temperature abuse (TA) to be used as spoilage markers and compare them with the results obtained from microbiological counts.Freshly processed, boneless, skinless chicken breast meat from a commercial poultry processing plant was transported to Auburn University's Department of Poultry Science (4 degrees C). Individual fillets were placed in whirl-pak bags and subjected to TA cycles of 2 hours at 4 degrees C and 2 hours at 25 degrees C. Three regimens were used: (1) 4 degrees C for 24 hours (control), (2) TA for 12 hours, and (3) TA for 24 hours. After TA, the samples were stored at 4 degrees C and evaluated for microbiological spoilage and VCs on days 0, 2, 4, 6, and 8. On each sampling day, three samples were analyzed for aerobic and anaerobic plate counts and Lactic Acid Bacteria (LAB). Additionally, three samples per sampling day were used for volatile compound analysis using an Electronic Nose.Temperature abuse cycles for 12 and 24 h increased the anaerobic and LAB counts by 1 log, while aerobic counts remained similar to the control samples. Spoilage rate was highest in the 24h TA samples, followed by 12h TA and then by control. E-nose analysis indicated the presence of multiple volatiles, with a notable increase in volatiles on Day 8. Samples subjected to temperature abuse contained volatiles such as acetaldehyde, propanal, trimethylamine, 3-methylfuran, acetoin, and undecane associated with odors such as fatty, ammoniacal, rotten cabbage, rancid and pungent, emerging as indicators of meat spoilage.

Title: Off-target effects of lentiviral vectors in placental cells

Primary Author: Victoria Apel

Additional Authors: Cristine Camp;Rachel West;

Department/Program: Anatomy Physiology and Pharm

College: College of Veterinary Medicine

Abstract: Lentiviral vectors are a common way to introduce RNA interferences (RNAi) that cause loss-of-function effects in cells. While commonly used and well understood to create stably transduced cells, lentivirus can also have unanticipated off-target effects. In this study, we aimed to assess the off-target effects caused by lentivirus on human endogenous retrovirus (HERV) gene expression in the placenta. HERV were incorporated into the human genome by retroviral infections several million years ago. The placenta uses HERV to create the invasive, fusitive organ necessary for optimal communication between mother and fetus. We chose the BeWo immortalized placental cell line as these cells have high levels of HERV. We used a third-generation lentiviral vector containing a scrambled sequence of RNA not known to target the human genome. BeWos were plated for 50,000 cells per well and treated with lentiviral particles at an MOI of 10 and 25. The lentivirus was left on cells for 24 hours, then removed and replaced with standard growth media. After 48 hours, antibiotics were applied to select successfully transduced cells. RNA was extracted from the scrambled sequence cells (SC) and mRNA levels of HERV were evaluated compared to wild type (WT) cells. Cells treated at an MOI of 25 had a significant reduction in *ERVFRD-1* ($p < 0.0001$) while cells treated at an MOI of 10 had a slight reduction ($p = 0.16$). As HERV drive differentiation in placental cells, WT and SC cells were evaluated for their capability to produce human chorionic gonadotropin (hCG) and syncytialize, both hallmarks of placental differentiation. Cells were treated with a cAMP agonist Forskolin and after 48-hours spent culture medium was collected and an ELISA was performed to quantify levels hCG secreted. SC cells secreted significantly lower levels of hCG compared to WT ($p < 0.001$). These data suggest that lentiviral vectors can influence HERV gene expression and cause functional disruptions in cells.

Title: Identification of a Macrocyclic Compound Targeting the Lassa Virus Polymerase

Primary Author: Virginia Aida

Additional Authors:

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: Lassa virus (LASV), the causative agent of Lassa hemorrhagic fever, is endemic to West Africa and causes up to 5,000 deaths annually. There are no approved vaccines or therapeutics to prevent or treat LASV infections. To identify compounds with anti-LASV activity, we conducted a cell-based compound screening campaign at biosafety level 4. Almost 60,000 compounds, including nearly 10,000 macrocyclic compounds, were tested for their ability to inhibit the growth of infectious, recombinant reporter LASV based on a clade IV sequence. Hits from this screen included a family of structurally related macrocycles. The most potent of these, Mac128, had sub-micromolar EC50 against the reporter virus, inhibited wild-type clade IV LASV, and reduced viral titers by over 4 orders of magnitude. Time-of-addition studies, as well as assays recapitulating individual steps in the viral life cycle, suggested that Mac128 acted at the level of viral replication; LASV glycoprotein-dependent entry and Z-protein budding were unaffected, but replication of the LASV minigenome was blocked. We found that Mac128 was less effective against LASV from clades other than IV and was ineffective against a clade II virus. In the minigenome assay system, switching clade IV and clade II support plasmids was consistent with Mac128 acting primarily at the level of the polymerase. Mac128 is a tool compound for studying LASV replication and a novel starting point for an optimization campaign with the aim of obtaining a candidate LASV therapeutic.

Title: Simulating loss of metals in leachate from fields fertilized with poultry manure.

Primary Author: Vishawjot Singh Sandhu

Additional Authors: Kritika Malhotra;Jasmeet Lamba;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The repeated application of animal litter to agricultural fields results in the accumulation of metals in the soil. The presence of soil macropores can enhance the loss of metals via subsurface flow pathways. The objective of this study was to simulate the loss of metals in leachate using the HYDRUS-1D model. Intact, undisturbed soil columns (25 cm in length and 15 cm in diameter) were collected for this study. The columns were fertilized with the poultry litter, and rainfall simulations were performed on these columns to determine the loss of metals in the leachate. Following rainfall simulations, the HYDRUS-1D model was used to simulate the fate and transport processes of metals. The model was calibrated and validated using the observed tracer data obtained from the column experiments. A mobile-immobile model was used to calibrate the physical non-equilibrium processes in HYDRUS-1D. A dual-porosity model with physical and chemical non-equilibrium was used to simulate the transport of metals in the soil profile. Copper and zinc transport were modeled using observed effluent data. Copper showed a higher affinity for soil than zinc. Thus, the effect of this varying sorption of the metals on the soil, when coupled with the preferential flow due to macropores, will govern the fate and transport of trace metals from the soils amended with poultry litter.

Title: Evaluation of loblolly pine wood biochar properties derived from slow-pyrolysis process for the synergetic benefit of carbon sequestration and soil conditioning.

Primary Author: Vivian Chimezie Usha

Additional Authors: Sushil Adhikari;Bijoy Biswas;Dale Hartmann;Hossein Jahromi;

Department/Program: Biosystems Engineering

College: College of Agriculture

Abstract: The expanding research in biochar production attempts to enhance the economic value of plant and animal waste by converting it into a cost-effective product with both environmental and agronomic benefits. This study investigated the characteristics of loblolly pine biochar that was produced through slow pyrolysis using a rotary tube furnace at three temperatures (450℃, 550℃, and 650℃). An investigation was conducted to examine the impact of pyrolysis temperature on both the yield and characteristics of biochar produced. The appropriateness of biochar samples for carbon sequestration and soil conditioning was evaluated based on the properties of biochar. The pyrolysis temperature had a notable influence on the characteristics of the biochar samples generated. The highest biochar yield of 23%%20was observed at 450℃ with a hydrophilic static contact angle of 82.75°, pH of 6.29, EC of 0.17 dS/m, presence of some essential soil nutrient, and induced half-life of 100-1000years (with heavy metal detection below EPA threshold). The static contact angle indicates the presence of a hydrophilic surface functional group and good wetting properties. Biochar samples generated at 550℃ and 650℃ exhibited hydrophobic static contact angles of 122.2° and 123.6° respectively, the presence of some essential soil nutrients, and an induced half-life greater than 1000 years. This suggests biochar produced at 450℃ has more potential for soil conditioning application and biochar generated at 550℃ and 650℃ has more potential for carbon sequestration. However, all biochar samples produced can offer synergetic benefits of carbon sequestration while improving soil health without any heavy metal contamination concerns.

Title: Hydrogen doping in brownmillerite perovskites: Unlocking electronic and magnetic property modulations

Primary Author: Vladislav Korostelev

Additional Authors: Konstantin Klyukin;

Department/Program: Materials Engineering

College: Samuel Ginn College of Engineering

Abstract: Iono-electronics, a field focusing on the dynamic insertion of small ions such as hydrogen, transforms material properties with minimal structural change. This technique significantly alters electronic and magnetic structures, affecting mechanical, optical, and thermal characteristics, and can induce superconductivity and magnetic phenomena like skyrmion formation, without major disruption to crystal structures. The complexities of hydrogen's interaction with complex oxides, particularly brownmillerite oxides, are not fully grasped despite their significant technological promise. These oxides are noted for their exceptional magnetic, superconducting, and insulator-to-metal transitions. Exploration in this domain has been limited to early-stage devices, highlighting the need for deeper atomic-level insights and an expanded range of materials for hydrogen-based nanoelectronics. In our presentation, we will investigate the impact of hydrogen intercalation on the electronic and magnetic characteristics of brownmillerite perovskites, utilizing state-of-the-art meta-GGA U and hybrid approaches in density functional theory (DFT). We will focus on the implications of hydrogen insertion on the electronic structures, particularly its position within the Density of States, and the magnetic exchange interactions (J1, J2, J3) in A2B2O5 perovskites. Our examination will cover aspects such as hydrogen and electron localization, changes in magnetic exchange couplings, absorption energy and preferred sites for intercalation. This analysis aims to shed light on the complex interaction between hydrogen and A2B2O5 perovskites materials.

Title: Reading Recall Using Rapid Serial Visual Presentation (RSVP): An Extension of Busler and Lazarte, 2017

Primary Author: Walton Ferguson

Additional Authors: Joaquin Sarmiento Naraza;Alejandro Lazarte;

Department/Program: PSYC Sciences

College: College of Liberal Arts

Abstract: Efficient readers will instate a short pause at the end of phrases (i.e., after punctuation marks), often referred to as the “wrap-up effect.” Using Rapid Serial Visual Presentation, Busler and Lazarte (2017) demonstrated improved recall ability when readers were forced to pause at the end of clauses (imitating the wrap-up effect) when compared to a condition with no pauses. The present study intends to replicate Busler and Lazarte’s findings and include an additional RSVP condition: pauses at random positions within clauses rather than at the end. This study also examines a new method of scoring recalls using a Python-based sentence transformer model. Using reading extracts from early English novels, participants (N = 16) were presented 8 readings of “easy” difficulty and 8 of “hard” difficulty and prompted to recall what they read. Readings were randomly presented using one self-paced and three RSVP conditions: no pauses, end-of-phrase (EOP) pauses, and within-phrase (WP) pauses. We utilized the SentenceTransformers Python module to calculate a semantic similarity (SS) score—indicating the similarity between a participant’s response and the reading—for each response. SS scores were averaged by difficulty level at each presentation condition. We then ran a repeated measures ANOVA to compare the impact of presentation condition, reading difficulty, and their interaction on SS scores. We hypothesized SS scores to be higher for “easy” readings and adhere to the following pattern for the presentation conditions: WP pauses < no pauses < EOP pauses < self-paced. SS scores were significantly related to reading difficulty but not presentation condition. However, the average SS scores for “hard” readings trend as hypothesized. The small sample size or poor performance of the sentence transformer model may contribute to the lack of significance. Future work should consider larger sample sizes and further validation of sentence transformer models to assess recall ability.

Title: The role of co-creation in event satisfaction and artist loyalty (Taylor's Version)

Primary Author: Wendi McLain

Additional Authors: Yee Ming Lee;

Department/Program: Hospitality Management

College: College of Human Sciences

Abstract: Music concerts are an integral part of the event industry. For instance, the Taylor Swift Eras tour grossed an estimated $1 billion from 4.35 million tickets sold in 2023. With the launch of this tour came a new way for attendees to participate in the experience of a concert, called co-creation. Co-creation is the process of producing new value through joint, collaborative, and concurrent activities. This study explores attendees' experiences with co-creation during their multiphase participation in a Taylor Swift Eras concert using an exploratory sequential mixed method. During the first phase of the study, qualitative data will be collected from 30 in-depth interviews with the attendees to understand their utilitarian (i.e., worthy of monetary spending) and hedonic (i.e., sense of belonging) values experienced when engaging in customer-to-customer co-creation across anticipatory, experiential, and reflective phases of the overall concert experience. NVivo (qualitative data analysis software Version 8.0, 2008) will be used to identify themes and sub-themes. The second phase of the study will involve a quantitative survey administered to 350 concert attendees through a convenience sampling method. This survey will measure the extent of co-creation through multiphase participation and the role that co-creation plays in event satisfaction and artist loyalty. SPSS software will be used to analyze quantitative data. The descriptive statistics and multiple regression analysis will be used to describe the data and test the relationships between variables. The implications of this study include identifying the importance of co-creation in overall event satisfaction and artist loyalty. By exploring multiphase participation, the study will reveal both utilitarian and hedonic values that the attendees experienced while participating in co-creation activities with other concert attendees.

Title: Sensory spaces: Inclusive design for all

Primary Author: William Bozeman

Additional Authors:

Department/Program: School of Architecture Plan and Landscape Architecture

College: College of Architecture, Design and Construction

Abstract: Surrounding one's environment with nature activates the parasympathetic nervous system and the sympathetic nervous system, which promotes mental health. The "Green Mind Theory," connects the body with natural and social elements. The constant presence of natural elements is proven to be beneficial to the brain and body as a whole. The brain is split up into two main categories when examining its interaction with nature, the top and bottom brain. This "Green Mind Theory" is a product of the activated parasympathetic nervous system (top brain) along with the sympathetic nervous system (bottom brain). The benefits vary in quantity dependingon the user's focus, attention, awareness, and immersion. Benefits can also include longer-lasting memories, which occur when neurons are created by the hippocampus as a reaction to an enriched environment. While natural spaces are beneficial to everyone, they can bedesigned in a way that is especially beneficial to those with mental disabilities. Sensory gardens provide a wide range of sensory experiences for users to interact with. This includes different features, surfaces, objects, and plants to stimulate the human senses. While normal gardens utilize senses in everyone, these gardens are specially designed and tailored to the needs of those with special needs. Research shows that sensory gardens are most successful when interacted with in stations. This also allows children to be more social and interactive. Sensory gardens are more beneficial to these students than regular gardens and are engaged with insignificantly higher quantities.

Title: Posture and working memory: a mobile EEG study

Primary Author: William Farr

Additional Authors: Danielle Lang;Kristina Neely;

Department/Program: School of Kinesiology

College: College of Education

Abstract: The relationship between posture and working memory is not well understood in college students. Here we seek to understand the relationship between posture and working memory utilizing mobile electroencephalography (mEEG). Participants ages 19-25 performed an approximately two-minute working memory n-back task. The task involved continuous recognition measures that present stimulus sequences; for each item in the sequence, participants judge whether the current stimulus matches the one presented "n" items ago. The task was performed in the standing, sitting upright, and supine positions while wearing a Muse EEG headband device. Here we report the descriptive statistics for the n-back task from 3 participants (1 woman), 20-21 years old. For the number of "hits" or correct responses, the range was from 9-10 for standing, 8-10 for sitting, and 7-10 for supine. For the number of "misses", the range was from 0-1 for standing, 0-2 for sitting, and 0-3 for supine. Before each condition, participants were asked about their level of sleepiness (Karolinska Sleepiness Scale, KSS). KSS scores ranged from 2-7 for standing, 2-6 for sitting, and 2-7 for supine. In the next phase of this investigation, we will conduct a spectral frequency analysis of resting state EEG obtained for approximately two minutes before each n-back task is performed. We plan to recruit 30 participants to complete this study. We hypothesize that beta frequencies will be more prominent in the working memory tasks in the standing and sitting upright postures. A direct relationship between n-back task accuracy and beta frequencies is also expected.

Title: Delineating cellular biosignaling mechanisms related to aging: investigating their effect on innate immunity and apoptosis within the heart of long-lived Ames dwarf mice

Primary Author: William Stapleton

Additional Authors: Muralikrishnan Dhanasekaran;Courtney Alexander;Preston Cook;Keyi Liu;Suhrud Pathak;

Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Some reports indicate that the essential cellular components (various organelles) promote the "controlled" formation of prooxidants and consequently trigger pro-inflammatory markers (putative biosignaling cascade associated with innate immunity) to reduce pathogen-mediated injury/insult, decrease the risk for tumor/malignancy which can then significantly augment the lifespan of animals and humans. The heart, a vital organ in the body, plays an important physiological role in regulating organismal lifespan. In addition, aging is associated with a gradual and continual decrease in cardiac functions. Not many valid in vitro/ in vivo chemically-induced or genetic models exist to assess the biosignaling mechanisms related to aging. Ames dwarf mice (exhibit a point mutation in the prophet of pit-1 gene) are phenotypically distinguished by small body size and delayed puberty (lacking growth hormone, thyrotropin, and prolactin), live considerably longer, 49–64%, 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 their age-matched controls are unknown. Hence, in this study, the markers of oxidative stress (Hydrogen Peroxide), inflammation (Interleukin Converting Enzyme-1 (ICE-1) and cyclooxygenase activities (COX)), apoptosis (serine protease, caspase-3,8,9 activities), and mitochondrial NADH content were measured in the Ames mice and its age-matched wild type controls (6 and 20-months old). Statistical analysis was performed using Prism-IX software (La Jolla, CA, USA). The noteworthy findings in the study are that the serine protease, Caspase, ICE-I, and COX activities were significantly increased in the Ames dwarf mice. Thus, the current research elucidating the signaling interplay of prooxidants, apoptotic, and inflammasome pathways in the heart of growth hormone-deficient mice improved our understanding and knowledge regarding the concepts related to aging.

Title: Cost-effectiveness of cemiplimab plus chemotherapy versus pembrolizumab plus chemotherapy as the first-line treatment for advanced non-small cell lung cancer: A preliminary study

Primary Author: Xiangzhong Xue

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Department/Program: Health Outcomes Research and Policy

College: Harrison College of Pharmacy

Abstract: Objective: Pembrolizumab, a monoclonal antibody binding to the protein PD-1, in combination with chemotherapy (PCT) has been a cost-effective, first-line treatment for patients with advanced non-small cell lung cancer (NSCLC) regardless of PD-L1 levels. In 2022, the U.S. FDA approved cemiplimab, in combination with chemotherapy (CCT), as another first-line treatment. This study evaluated the cost-effectiveness of CCT versus PCT for patients with advanced NSCLC from a U.S. healthcare payer perspective. Methods: We constructed a Markov model to evaluate the cost-effectiveness of CCT compared to PCT as the first-line treatment for patients with advanced NSCLC. The time horizon for the model was 10 years. The effectiveness and transition probabilities of CCT and PCT treatment regimens were extracted from the survival data of the EMPOWER-LUNG 3 trial and a network meta-analysis, respectively. Treatments' costs were obtained from the Centers for Medicare.

Title: An integrated platform for monitoring the cytokine release in immunotherapy

Primary Author: Xuejia Kang

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Department/Program: Drug Discovery and Development

College: Harrison College of Pharmacy

Abstract: Chimeric Antigen Receptor T-cell therapy (CAR T) has revolutionized leukemia treatment, but uncontrolled cytokine release limits its effectiveness. Monitoring and managing cytokine release dynamics is crucial for optimizing CAR T therapy. However, current in vitro assessments are time-consuming and require large sample volumes, disrupting the CAR T cell niche. To address these challenges, an integrated real-time 3D vascularized blood-brain barrier (BBB) chip was introduced. This chip accurately replicates the BBB infiltrated by CAR T cells and monitors immune profiling. It enables real-time cytokine detection during CAR T cell interactions with other cells, covering various aspects such as T cell movement, leukemia recognition, immune activation, cytotoxicity, and cell killing. Additionally, CAR T therapy's effects was examined on brain cells, identifying factors contributing to neurotoxicity. Furthermore, cytokine release was monitored in the BBB chip after treating the device with anti-cytokine therapeutics. By effectively monitoring CAR T therapy-induced cytokine release dynamics without disrupting the CAR T cell niche, this integrated chip allows researchers to explore immunotherapy and enhance its safety profile. This advancement holds promise for improving cancer treatment outcomes.

Title: Therapeutic potential of extracellular vesicles in treating rabies encephalitis

Primary Author: Yanthrawaduge Fernando

Additional Authors: Emily Davis;Anna Cochran;Henry Baker;Douglas Martin;Maria Naskou;

Department/Program: Pathobiology

College: College of Veterinary Medicine

Abstract: There are many pathogenic viruses that can cause viral encephalitis in humans that are mostly lethal and incurable. Infectious encephalitis is typically caused by a viral infection and transmitted to humans by carriers such as mosquitoes, ticks, insects, or animals. However, the blood brain barrier limits the delivery of treatments into the brain which makes treating infectious encephalitis difficult once it enters the central nervous system. Extracellular vesicles (EVs) derived from cell plasma membranes offer a unique platform for developing novel therapeutics with their ability to shuttle molecules between cells and through crossing the blood brain barrier. The objective of our study was to modify EVs with rabies virus glycoprotein (RVG) derived peptide in order to increase brain tropism and encapsulate anti-viral molecules for delivery to neuronal cells. We hypothesized that by engineering extracellular vesicles to express RVG we will increase their brain tropism and ultimately increase their efficiency to deliver anti-viral molecules to neuronal cells. Following transfection of cells to express RVG, engineered modified EVs were obtained and loaded with a surrogate siRNA (GAPDH). Subsequently, the efficacy of modified EVs to deliver their cargo was tested in neuronal cells and gene expression was evaluated. Our preliminary data showed successful modification of EVs with the RVG peptide and loading of a surrogate siRNA. Finally, we found that EVs were able to deliver their load to neuronal cells *in vitro*. We aim to test the ability of EVs to deliver anti-viral molecules using rabies as a model. Specifically, our future experiments are focusing on the modification and loading of EVs with specific anti-rabies viral molecules and test their therapeutic effect *in vivo* via biodistribution and gene expression assays.

Title: The Daunting Dilemma with Sentence Encoders: Glowing on Standard Benchmarks, Struggling with Capturing Basic Semantic Properties

Primary Author: Yash Mahajan

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College: Samuel Ginn College of Engineering

Abstract: In recent years, complex transformer-based models such as GPT's and LlaMa have garnered attention due to their advanced text generation abilities. Their high computational requirements, however, have made them inaccessible to a general audience. This has rejuvenated interest in classic sentence encoders such as Sentence-BERT (SBERT) and the Universal Sentence Encoder (USE), which are computationally efficient in standard hardware. However, little is known about their robustness in capturing sentence semantics. To study this, we conducted rigorous tests on classical and emergent LLM encoders. First, experimenting with the SentEval benchmark we discovered that encoders performed very similarly and there is not a clear winner. Second, we propose and evaluate sentence encoders with five criteria: \textit{paraphrasing, synonyms replacement, antonyms replacement, paraphrasing without negation, and sentence jumbling}. Surprisingly, SBERT is the best performer on \textit{paraphrasing} and \textit{paraphrasing without negation} tasks, as well as a top performer along with GPT3-Ada on \textit{synonyms replacement}. However, all models struggled on the \textit{antonyms replacement} and \textit{sentence jumbling} tasks, except LlaMa-2.These results demonstrate that language models still do not capture some of the basic semantic properties and thus, highlight the need for having rigorous benchmarks.

Title: Salt transport of phenyl acrylate-based anion exchange membrane with different crosslinkers for artificial photosynthesis

Primary Author: Yi-Hung Lin

Additional Authors:

Department/Program: Chemical Engineering

College: Samuel Ginn College of Engineering

Abstract: Anion exchange membranes (AEMs) play a crucial role in artificial photosynthesis devices utilizing photoelectrochemistry for converting CO2 into valuable products. These membranes facilitate the movement of charge carriers between electrodes while restricting the transport of CO2 reduction products like formate and acetate. Despite their significance, there is a limited amount of research on the fundamental transport mechanisms in AEMs used in artificial photosynthesis. In this study, we introduce the development of a phenyl acrylate-based membrane functionalized with (3-acrylamidopropyl) trimethylammonium chloride (APTA) and crosslinked using two different crosslinkers: poly(ethylene glycol) diacrylate (PEDGA) and N,N'-methylenebisacrylamide (MBAA). By varying the crosslinkers and APTA content, we successfully modified the membrane's water volume fraction, thereby controlling its transport properties. Typically, membranes with a higher water volume fraction tend to exhibit higher salt permeability. The decrease in permeabilities to solutes with increasing crosslinker is attributed to a reduction in water volume fraction. The observed order of permeabilities for NH4Cl> KCl> KOFm> KOAc> NaOFm> NaOAc is likely due to variations in hydration diameters. Interestingly, two membranes with similar water volume fractions but different solute permeabilities were observed. This difference is attributed to variations in diffusivity and solubility, influenced significantly by the glass transition temperature, causing decreased permeability. Additionally, Young's modulus increases with higher crosslinker content, reflecting a higher crosslink density, and films containing MBAA exhibit higher yield strength compared to those with PEGDA.

Title: Alzheimer's disease lipid biomarkers characterization using liquid chromatography ion mobility mass spectrometry (LC-IM-MS/MS)

Primary Author: Zachary Love

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Department/Program: Chemistry & Biochemistry

College: College of Sciences and Mathematics

Abstract: Alzheimer's Disease (AD) is a type of neurodegenerative disease, with similar symptoms to dementia. In addition, AD is the 6th leading cause of deaths in the US with an estimate increase of 13.8 million cases by the year 2060. Furthermore, its financial burden is higher than that of the cost of care for cancerous diseases such as breast cancer and prostate cancer. Unfortunately, AD can only be treated to slow down the progress of the disease. One of the biomarkers used to study diseases, such as AD, is lipids. Lipids show great diversity and complexity in their structure that usually requires high resolution techniques to separate them. Therefore, ion mobility (IM) plays a significant role in separating and identifying these lipid structures because IM separates ion structures based on their size, shape, charge, and mass under the influence of an electric field with a collision buffer gas. We developed a method utilizing LC-IM-MS/MS to detect and identify the lipid biomarkers of Alzheimer's Disease using gangliosides and phospholipids standards. From the result obtained, it was clear that the gangliosides were less abundant in the positive and more abundant in the negative mode. From the IM spectra, ganglioside GD 36:1 and GD 38:1 resulted in two peaks, while the phospholipid PE 38:8 resulted in 3 peaks, indicating the presence of isomers and/or conformers. Utilizing the same method for AD and non-AD samples resulted in clear discrimination in the PCA plots. For future work, rapid detection methods will be used to analyze AD and non-AD samples such as paper spray (PS)-IM-MS/MS and a portable IM device.

Title: Conducting a motion study on the proximal and distal interphalangeal joints of the index finger to estimate and characterize tremor events by frequency

Primary Author: Zachary Miller

Additional Authors: Chad Rose;

Department/Program: Mechanical Engineering

College: Samuel Ginn College of Engineering

Abstract: Tremor is a neurological condition that can cause involuntary, chaotic twitching motions in the body that can negatively impact the daily lives of many individuals. While some treatment options like medication or surgery exist, these solutions often come with complications and may not be appropriate for every situation. Mechanical, non-invasive solutions rely on passive, constant damping elements applied to the whole hand, suppressing tremor. Unfortunately, this also suppresses any desired motion, which can get in the way of the wearer. To remedy this over-suppression of movement, a more active design should be considered. An active tremor solution should utilize a closed feedback loop to detect when tremor is occurring, and then to apply the suppressing effect only when needed. However, accurately estimating and categorizing tremors is a difficult task due to its random, chaotic nature. The objective of this research was to study the motion of the index finger to determine and differentiate between voluntary motion and involuntary tremor. Categorizing whether a motion is tremor or not is done by observing the motion's frequency. This study was conducted by attaching an inertial measurement unit (IMU)to both the proximal and distal interphalangeal (PIP and DIP) joints in the index finger of the left hand and flexing and extended the finger at a constant rate for 20 seconds. By taking the acceleration data from the IMUs and processing the data using a Fast Fourier Transform, it was determined that the DIP joint experienced motion at frequencies of 0.5, 6.5, and 8.6 Hz while the PIP joint saw frequencies of 2.1, 4.3, and 5.8 Hz. Using these frequencies, a low-pass filter can be intelligently designed to filter out the voluntary motion present in the data to better study the tremor itself.

Title: Streamlining LC-MS method optimization for quantitative analysis of CYP metabolites: Exploring QTOF mass spectrometry strategies

Primary Author: Zarna Atul Raichura

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Department/Program: Drug Discovery and Development

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Abstract: In bioanalytical method development, our work utilizes mass spectrometry-QTOF to quantify cytochrome P450 (CYP) metabolites from enzymatic assays. The optimization and troubleshooting of LC-MS parameters are vital for precise separation and identification of diverse metabolites. With respect to chromatography parameters, the Poroshell 120 CS-C18 column, with 2.1x50 mm dimensions and 2.7-micron specifications, was used. The positive charge functionalized on the C18 silica surface enhanced the peak shape for basic analytes, minimizing tailing and secondary interaction. Furthermore, this column facilitated a shorter analysis time (3 minutes) compared to most published methods, demonstrating its time efficiency. Considering mobile phase conditions, maintaining weak ionic strength using formic acid (FA) ensured method robustness. Sample preparation involved dilution with H2O and 0.4% FA in acetonitrile for improved chromatography. The developed method employs mobile phase A (0.1% v/v FA in H2O) and B (0.1% v/v FA in acetonitrile) at a flow rate of 0.6 mL/min, with injection volumes of 10 uL for positive and 5 uL for negative ESI samples. Whereas for mass spectrometry, parameters such as ionization modes, matrix effects, appropriate internal standard, voltage selection and non-specific metabolism with respect to CYPs should be deliberated. Optimization of fragmentor voltage is crucial; at 175V, false positive metabolite detection occurred due to substrate fragmentation, resolved by switching to 100 V. Although QTOF may be viewed as restrictive for quantitative analysis compared to triple quadrupole instruments, it has proved to be efficient due to its mass accuracy and high resolution. These method development parameters, focusing on quantifying metabolites, are extended to evaluate the potential of CYP inhibition by botanical extracts. Further based on IC50 values, subfractions of the extract will be tested to identify the compounds responsible for the observed activity.