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Fall Graduate Research Symposium 2023

Poster | Oral Presentations

SATURDAY, OCTOBER 21st, 2023
8 AM TO 4 PM
OLD MAIN ACADEMIC CENTER

MISSISSIPPI STATE UNIVERSITY
GRADUATE STUDENT ASSOCIATION

MISSISSIPPI STATE UNIVERSITY
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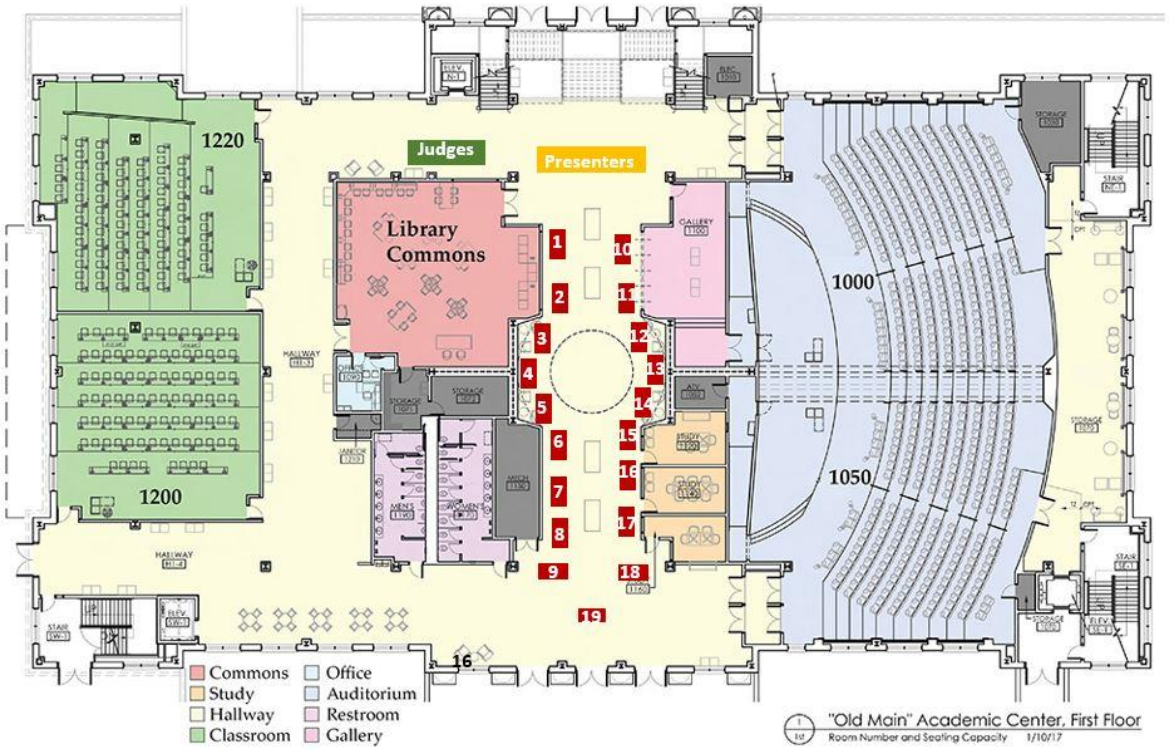
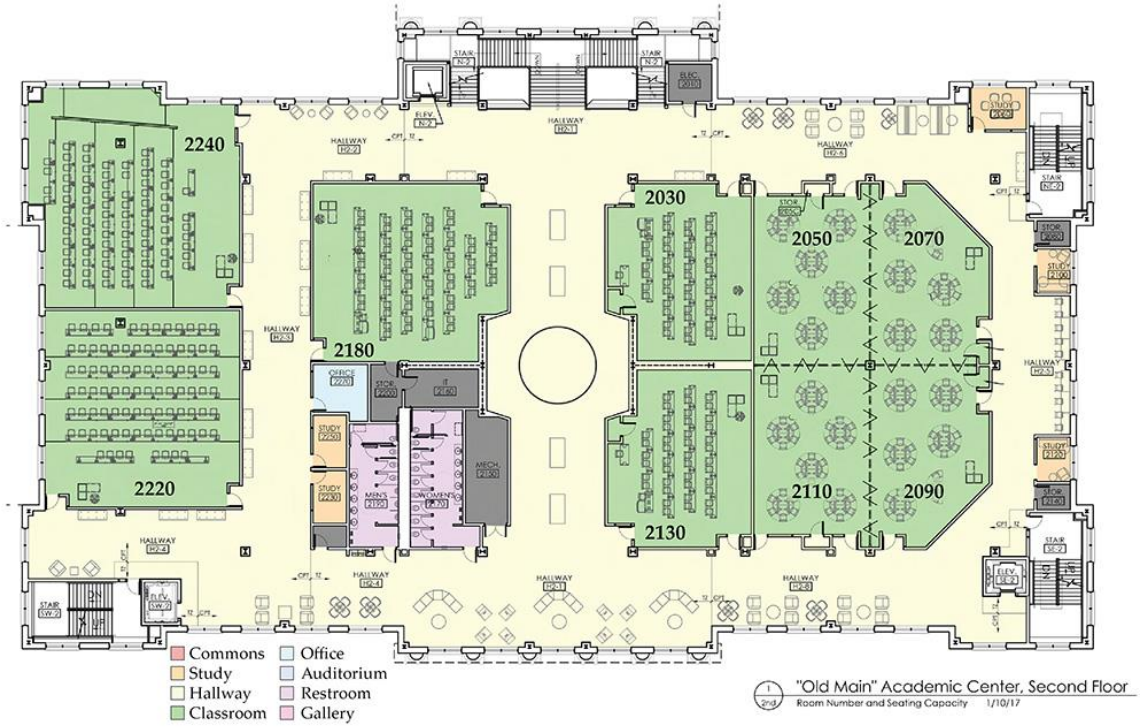


SIGN IN STUDENTS

SIGN IN JUDGES

Poster Presentations



SCHEDULE

Session	Location	Time
AM Poster 1	1st Floor Lobby	8 AM – 10 AM
AM Poster 2	1st Floor Lobby	8 AM – 10 AM
AM Poster 3	1st Floor Lobby	10:00 AM – 12 PM
AM Poster 4	1st Floor Lobby	10:00 AM – 12 PM
AM Oral 1	Room 1200	8 AM – 9:15 AM
AM Oral 2	Room 1220	8 AM – 9 AM
AM Oral 3	Room 2130	9:30 AM – 10:15 AM
AM Oral 4	Room 2180	9:30 AM – 10:15AM
AM Oral 5	Room 1200	10:30 AM – 11:30 AM
AM Oral 6	Room 1220	11 AM – 12 PM
AM Oral 7	Room 2130	11:15 AM – 12 PM
PM Poster 1	1st Floor Lobby	1 PM – 3 PM
PM Poster 2	1st Floor Lobby	1 PM – 3 PM
PM Poster 3	1st Floor Lobby	3 PM – 4:00 PM
PM Poster 4	1st Floor Lobby	3 PM – 4:00 PM
PM Oral 1	Room 2130	1 PM – 2 PM
PM Oral 2	Room 1200	1 PM – 1:45 PM
PM Oral 3	Room 1220	1:30 PM – 2:45 PM
PM Oral 4	Room 2180	2 PM – 3 PM
PM Oral 5	Room 2130	3 PM – 4 PM
PM Oral 6	Room 1200	3 PM – 4 PM
PM Oral 7	Room 1220	3 PM – 3:45 PM

MORNING SESSION: 8 AM—12 PM

Poster Sessions

Poster Session 1

8 AM – 10 AM

1st Floor Lobby

Evaluators:

1. Mostafa Mohammadabadi, Engineering
2. Vidanelage Lakshika Dayarathna, Engineering
3. Maryam Mirabolghasemi, Engineering

Participants:

1. Rejane S. Paulino, Engineering, *Monitoring of cyanobacteria blooms in tropical urban reservoirs using remote sensing*
2. Chamika A. Silva, Engineering, *Can the moisture impact on VisNIR and MIR spectra be mitigated to calibrate robust predictive models for soil properties?*
3. Dakota James Hester, Engineering, *Semi-supervised Land Cover Classification of High Spatial Resolution Aerial Imagery with Contrastive Deep Learning*
4. Cemre Omer Ayna, Engineering, *Task-Specific Hyperspectral Band Selection with Machine Learning*
5. Bidya Debnath, Engineering, *UAV Swarm based isotropic Planar Aperiodic Phased array of Dipole Antenna.*
6. Sabyasachi Biswas, Engineering, *CV-SincNet: Learning Complex Sinc Filters from Raw Radar Data for Computationally Efficient Human Motion Recognition*
7. Yehong Peng, Engineering, *Towards Grid Resilience: Efficient Reserve Constrained AC Optimal Power Flow*
8. Mahathir Mohammad Bappy, Engineering, *Adaptive Thermal History Deidentification for Privacy-preserving Process-defect Modeling of Metal Additive Manufacturing*
9. Ally Cummings, Engineering, *Effect of Toolpath on the Thermomechanical Response for Finite Element Modeling of Wire-Arc Directed Energy Deposition*

Poster Session 2

8 AM – 10 AM

1st Floor Lobby

Evaluators:

1. Tim Boltz, Agriculture and Life Sciences
2. Cory Gallo, Agriculture and Life Sciences
3. Beth Peterman, Agriculture and Life Sciences

Participants:

1. Apphia Santy, Agriculture and Life Sciences, *Raspberry Cultivar Evaluation Trial In Mississippi*
2. Manoj Kumar Reddy Allam, Agriculture and Life Sciences, *Characterization of Nod Glycine rich proteins in root nodule development of Medicago truncatula*
3. Michael Althman, Agriculture and Life Sciences, *Influence Of Flight Height And Spray Qualities On The Swath Width Of A Dji T40 Drone*
4. Mohan Kumar Bista, Agriculture and Life Sciences, *Phenotyping of Cotton Breeding Lines for Drought Tolerance*
5. Raveendra Chandavarapu, Agriculture and Life Sciences, *Marker-assisted introgression of OsPSTOL1 gene for low soil phosphorus tolerance in rice*
6. Vijaykumar S Hosahalli, Agriculture and Life Sciences, *Effect of Biostimulants in Alleviating Heat and Drought Stress in Soybean*
7. Yasas Gamagedara, Agriculture and Life Sciences, *Investigating the feasibility of using mid-infrared fine-ground soil spectra to predict non-fine-ground soil spectra*
8. Emmanuel Oladejo, Agriculture and Life Sciences, *Effects of supplementation of DL-Met on serum and liver antioxidant status of oxidatively stressed growing pigs*
9. Rezwana Rahman Setu, Agriculture and Life Sciences, *Analysis of Systemic Acquired Resistance by Monitoring Redox-Mediated Transcriptional Dynamics in Arabidopsis*
10. Lauren Jennings, Agriculture and Life Sciences, *Developing a Pollen Nutrition Database for North America*

Poster Session 3

10 AM – 12:00 PM

1st Floor Lobby

Evaluators:

1. Hailey Ripple, Education, Arts and Sciences, and Business
2. Anna Osterboltz, Education, Arts and Sciences, and Business

Participants:

1. Claire Bland, Education, Arts and Sciences, and Business, *Motivational Factors in Online Learning*
2. Grace Austin and Seger McGuire, Education, Arts and Sciences, and Business, *Positive Creativity in Higher Education: Investigating Rural Mississippi*
3. Samuel Stewart, Education, Arts and Sciences, and Business, *Relationship Between Scientific-reasoning Skills and Thinking Styles in University Students*
4. Amber Crenshaw, Education, Arts and Sciences, and Business, *Examining Trajectories of Academic Achievement in Native and Non-Native English Speakers: Preliminary Findings Based on National Samples*
5. Chathuri Peiris, Education, Arts and Sciences, and Business, *Metal Cation-Induced Surface Nanoengineering of Lignin-Enriched Softwood and Hardwood Fibers for Sustainable and Water-Resistant Food Packaging.*
6. Timothy Sellers, Agriculture and Life Sciences, *A Heterogeneous Multi-Robot System for Early Radiation Detection in Power Plants*
7. Zihan Li, Agriculture and Life Sciences, *Cover crops effects on nitrous oxide flux during growing season in Mississippi corn cropping system*
8. Ayuumah Sandys Seth, Education, Arts and Sciences, and Business, *Positive Creativity in Higher Education: Investigating Rural Mississippi*

Poster Session 4

10 AM – 11:45 AM

1st Floor Lobby

Evaluators:

1. Rinat Gabitov, Education, Arts and Sciences, and Business
2. Beth Peterman, Agriculture and Life Sciences
3. Nathan Hammond, Education, Arts and Sciences, and Business

Participants:

1. Aaron Griffith, Education, Arts and Sciences, and Business, *The Y-Balance Test As A Measure Of Dynamic Stability Among Colliegiate American Football Players*
2. Brantley K. Ballenger, Education, Arts and Sciences, and Business, *Moderation Of Body Fat On The Relationship Between Age And Arterial Stiffness In Down Syndrome*
3. Georgia Starr, Education, Arts and Sciences, and Business, *Physical Activity And Sedentary Behavior Levels And Patterns In Adults With And Without Down Syndrome*
4. Lauren K. Smith, Education, Arts and Sciences, and Business, *Investigating The Relationship Between Body Composition, Perceived Stress, And Life Satisfaction In Marching Band Members*
5. Maria Haider, Education, Arts and Sciences, and Business, *Geneactiv Accelerometer Cut Points For Adults With Down Syndrome*
6. Morgan Wood, Education, Arts and Sciences, and Business, *Ammonia Inhalants Do Not Improve Fatigability During Endurance Exercise*
7. Ian C. Macali, Education, Arts and Sciences, and Business, *Health Characteristics Of Marching Band Participation*
8. Sujita Balami, Forest Resources and Veterinary Medicine, *First Report of Streptococcus dysgalactiae subsp. dysgalactiae Associated with Mortality Events in Catfish Aquaculture in Mississippi, USA: A Case Study*
9. Kelechi Godwin Ibeh, Forest Resources and Veterinary Medicine, *Evaluation of ecosystem response to silvicultural treatments in upland oak forests in northern Mississippi.*
10. Christiana Eziashi, Education, Arts and Sciences, and Business, *Effects of Nutrients and Salinity on Water Quality and Ecosystem of the Western Mississippi Sound*

Oral Sessions

Oral Session 1

8 AM – 9:15 AM

Room 1220

Moderator: Kerington Bass and Suman Pradhan

Evaluators:

1. Sarah Lalk, Education, Arts and Sciences, and Business
2. Sara Vick, Education, Arts and Sciences, and Business
3. Galen Collins, Agriculture and Life Sciences; Education, Arts and Sciences, and Business; Forest Resources and Veterinary Medicine

Participants:

1. Arma Regmi, Education, Arts and Sciences, and Business, *Increased cathode capacity of the Ni-Fe battery using sulfide addition*
2. Chibuike Onyeogulu, Education, Arts and Sciences, and Business, *Reproducibility of drift gas modifier effects in ion mobility spectrometry*
3. Jayamini Hewage, Education, Arts and Sciences, and Business, *High surface area rice husk biochar for supercapacitor electrodes*
4. Olufemi Ademola Farotimi, Education, Arts and Sciences, and Business, *Hydrogen/Deuterium Exchange Predictions as an Approach to Winnow the Possible Isomer Identities of Metabolite Features in Mass Spectrometry*
5. Taofiq Abdulraheem, Education, Arts and Sciences, and Business, *Gas-phase dissociation and thermal decomposition study of ionic liquids: Focusing on 1-butyl-3-vinyl imidazolium chloride*

Oral Session 2

8 AM – 9 AM

Room 1200

Moderator: Aidan Taylor

Evaluators:

1. Wenmeng Tian, Engineering
2. Lu He, Engineering
3. Harish Chander, Engineering

Participants:

1. Aditya Shah, Engineering, *Stitched composites for damage tolerant aerospace structures*
2. Fahmida Islam, Engineering, *Design and Optimization of a Deep Reinforcement Learning (DRL) based Longitudinal Velocity Control Model*
3. Timothy Sellers, Engineering, *Enhancing Emission Monitoring in Power Plants with a Multi-Robot Graph-Based System*
4. Abdur Rahman, Engineering, *MoistNet: Machine Vision-based Deep Learning Models for Wood Chip Moisture Content Measurement*

Oral Session 3

9:30 AM – 10:15 AM

Room 2130

Moderator: Mary Miller

Evaluators:

1. Ling Li, Agriculture and Life Sciences
2. Sarah Lalk, Education, Arts and Sciences, and Business

Participants:

1. Gabriel F. Nyen, Forest Resources and Veterinary Medicine, *Down on Our Knees Hunting for Trees*
2. Timothy Gatlin, Forest Resources and Veterinary Medicine, *Hardwood seedling establishment and survival for aid in restoring and enriching bottomland hardwoods in the Lower Mississippi Alluvial Valley*

Oral Session 4

9:30 AM – 10:15 AM

Room 2180

Moderator: Sushma Perati

Evaluators:

1. Shankar Ganapathi Shanmugam, Agriculture and Life Sciences
2. Attila Karsi, Agriculture and Life Sciences; Forest Resources and Veterinary Medicine
3. Iva Ballard, Education, Arts and Sciences, and Business

Participants:

1. Sabina Regmi, Agriculture and Life Sciences, *Unveiling Broadband Adoption Disparities in Mississippi: Urban-Rural and Income Group Analysis*
2. Md Nurul Islam, Education, Arts and Sciences, and Business, *Politician Stock Trading Filing Violations: Oversight or Deliberate Exploitation of Private Information?*
3. Mohammad Shakiul Islam, Education, Arts and Sciences, and Business, *Estimation of Chlorophyll-a in Uncrewed Aircraft Systems Imagery using Autonomous Surface Vessel data by employing Machine Learning Algorithms and Innovative Feature Selection Approaches*

Oral Session 5

10:30 AM – 11:30 AM

Room 1200

Moderator: Emily Myers

Evaluators:

1. Harish Chander, Engineering
2. Iva Ballard, Education, Arts and Sciences, and Business
3. Maryam Mirabolghasemi, Engineering

Participants:

1. Caitlin Luke, Engineering, *Modification of benchtop impaction device to mimic cadaveric transforaminal lumbar interbody fusion (TLIF)*
2. Matthew Register, Engineering, *Finite Element Modeling of an Active Cooling Plate Design for Wire-DED of CP-Ti*
3. Yukai Ai, Engineering, *Characterization of single atmospheric aerosol particles using optical trapping technologies*
4. Riku Kikuta, Engineering, *Risk assessment and observation of driver with pedestrian using instantaneous heart rate and HRV*

Oral Session 6

11 AM – 12 PM

Room 1220

Moderator: Catherine Authement

Evaluators:

1. Tim Boltz, Agriculture and Life Sciences
2. Cory Gallo, Agriculture and Life Sciences

Participants:

1. Ashmita Poudel, Forest Resources and Veterinary Medicine, *Developing Near Infrared Spectroscopy (NIRS) Sampling Methodology for Modeling Species Discrimination in Live Catfish (Ictalurus sp.) for Aquaculture*
2. Darren Shoemaker, Forest Resources and Veterinary Medicine, *Challenges evaluating reservoir fish habitats in a changing climate*
3. Emma Schultz, Forest Resources and Veterinary Medicine, *On the Move: How Animal Movements During Drone Surveys Influence Count Error*
4. Hafez Ahmad, Forest Resources and Veterinary Medicine, *Hydrologic connectivity between lakes and rivers in the Lower Mississippi Alluvial Valley*

Oral Session 7

11:15 AM – 12 PM

Room 2130

Moderator: Erin Brooks

Evaluators:

1. Shankar Ganapathi Shanmugam, Agriculture and Life Sciences
2. Attila Karsi, Agriculture and Life Sciences; Forest Resources and Veterinary Medicine
3. Ling Li, Agriculture and Life Sciences

Participants:

1. Oluwabori Adekanye, Forest Resources and Veterinary Medicine, *Transcriptomic Analysis Of Carboxylesterase 1 (Ces1) Knockdown Thp-1 Macrophages At Baseline (M0) And Classically Activated (M1) Thp-1 Macrophages Reveal Similar Expression Signatures.*
2. Ridwan T. Ayinla, Forest Resources and Veterinary Medicine, *Biomass-derived electrode and electrolyte for green supercapacitors*
3. Fenny Patel, Forest Resources and Veterinary Medicine, *Mutation of TAD operon in Aeromonas hydrophila ML09-119 for determining its role in bacterial virulence.*

AFTERNOON SESSIONS: 1 PM TO 4:15 PM

Poster Sessions

Poster Session 1

1 PM – 3 PM

1st Floor Lobby

Evaluators:

1. Gwendolyn Boyd-Shields, Forest Resources and Veterinary Medicine; Agriculture and Life Sciences
2. Lindsey Shelton, Education, Arts and Sciences, and Business

Participants:

1. Matthew Scott, Forest Resources and Veterinary Medicine, *Microbiomics of Amazonian Fishes*
2. Krista Ruppert, Forest Resources and Veterinary Medicine, *Assessment of the Genetic Diversity and Relatedness of Gopher Frogs (Rana [Lithobates] capito) on the Conecuh National Forest, Covington County, AL*
3. Fenny Patel, Forest Resources and Veterinary Medicine, *Metal Cation-Induced Surface Nanoengineering of Lignin-Enriched Softwood and Hardwood Fibers for Sustainable and Water-Resistant Food Packaging.*
4. Casey Iwamoto, Forest Resources and Veterinary Medicine, *Sustainable pathways for shortleaf pine (Pinus echinata) in uncertain climates*
5. Elizabeth Esser, Forest Resources and Veterinary Medicine, *Triploids, Tetraploids, and Hexaploids, Oh My! Cogongrass Ploidy Distribution Throughout the Invaded Range*
6. Richard O. Omotayo, Forest Resources and Veterinary Medicine, *Nondestructive evaluation of stiffness and strength of Cross Laminated Timber (CLT) made from different species - southern yellow pine, red oak, yellow poplar and sweet gum*
7. Jing Huang, Forest Resources and Veterinary Medicine, *Evaluating the effects of autochthonous bacteria Lactococcus lactis MA5 as feed supplement for hybrid catfish (Ictalurus punctatus × I. furcatus)*
8. David L. Pounders, Education, Arts and Sciences, and Business, *Population genomic structure of the Everglades Pygmy Sunfish yields evidence of vicariant speciation*

Poster Session 2

1 PM – 3 PM

1st Floor Lobby

Evaluators:

1. William Wang, Education, Arts and Sciences, and Business
2. Sydney Pullen, Education, Arts and Sciences, and Business
3. Dayna Emrick, Education, Arts and Sciences, and Business

Participants:

1. Sama Ebrahimi Bajgani and Georgia Wood, Education, Arts and Sciences, and Business, *4C Developmental Model of Courage: A Framework for Understanding and Measurement*
2. Hunter Derby, Education, Arts and Sciences, and Business, *The Effects of Acute Virtual Reality Exposure on Dynamic Postural Stability*
3. Kenzie Hargrove, Education, Arts and Sciences, and Business, *Sweat Rate and Hydration Assessment in Youth Cross-Country Athletes*
4. Russell Lowell, Education, Arts and Sciences, and Business, *Changes in countermovement jump performance across the preseason and season in Division 1 basketball players*
5. Samantha Searles, Education, Arts and Sciences, and Business, *Sex-based comparisons of isometric and isokinetic hamstrings-to-quadriceps ratio and muscle size*
6. Valencia Epps and Shamaria M. Mosley, Education, Arts and Sciences, and Business, *Untraining Implicit Biases*
7. Patricia Marie Cordero-Irizarry, Agriculture and Life Sciences, *Digital Natives or Novices? Exploring Online Learning Readiness in Undergraduate Students*
8. Samrat Sikdar, Agriculture and Life Sciences, *Illustrating the Notion of "Farm Innovation Brokers" in Pluralistic Extension Regime: A Conceptual Analysis*

Poster Session 3

3 PM – 4 PM

1st Floor Lobby

Evaluators:

1. Greg Burgreen, Engineering
2. Hussein Gharakhani, Engineering
3. Lauren Priddy, Engineering
4. Colleen Scott, Education, Arts and Sciences, and Business

Participants:

1. Niyati Chokshi, Engineering, *Slender Body aerodynamics instability at high-speeds and high angles of attack*
2. Zeenat Islam, Engineering, *Predicting moisture content and bulk density of various grains from their dielectric properties*
3. Eli Riser, Engineering, *Multi-robot Navigation using improved RRT*-Smart with Digital Twin Technology*
4. Fahmida Islam, Engineering, *Enhancing Velocity Control: Integrating Attention Mechanism and Deep Deterministic Policy Gradient (DDPG) for Optimizing Safety and Comfort*
5. M M Nabi, Engineering, *Deep-learning based Global Soil Moisture estimation using CYGNSS Delay Doppler Maps*

Poster Session 4

3 PM – 4 PM

1st Floor Lobby

Evaluators:

1. Nisarga Kodadinne Narayana, Agriculture and Life Sciences
2. Raju Bheemanahalli, Agriculture and Life Sciences
3. Prakash Kumar Jha, Agriculture and Life Sciences

Participants:

1. Urita Agana, Agriculture and Life Sciences, *Honey Bee Physiology and Gut Microbiome Diversity Along an Agricultural Intensification Gradient*
2. Oladayo Apalowo, Agriculture and Life Sciences, *Exploring the Role of Selenoprotein H on Selenium Distribution, Selenoprotein Expression, and Insulin Signaling in Aged Mice*
3. Sujan Poudel, Agriculture and Life Sciences, *Response of Cowpea to Drought Stress during Early Growth and Development*
4. Bala Subramanyam Sivarathri, Agriculture and Life Sciences, *Influence of Biostimulants on Soybean Seedling Vigor Traits Under Low and High Temperatures*
5. Durga Purushotham Mahesh Chinthalapudi, Agriculture and Life Sciences, *Evaluating Cover Crops and N fertilization Effects on Soil Microbiota, Soil Enzyme Activities and Nutrient Cycling in Corn Production Systems*
6. Hari Giri, Education, Arts and Sciences, and Business, *Phenothiazine-based polyaniline derivative: Effects of side-chain, solvent, and dopant on the conductivity*

Oral Sessions

Oral Session 1

1 PM – 2 PM

Room 2130

Moderator: Asishana Ajayi

Evaluators:

1. Fernando Yamamoto, Forest Resources and Veterinary Medicine; Agriculture and Life Sciences
2. Prakash Kumar Jha, Agriculture and Life Sciences
3. Greg Burgreen, Engineering

Participants:

1. Krista Ruppert, Forest Resources and Veterinary Medicine, *Upland Microhabitat Use by Gopher Frogs (Rana [Lithobates] capito) on the Conecuh National Forest*
2. Wentao Song, Forest Resources and Veterinary Medicine, *Variations in the responses of North American breeding bird populations to climatic changes*
3. Madalyn Stoecker, Forest Resources and Veterinary Medicine, *Forest Structure and Edge Effects on Bee Functional Diversity in Working Pine Forests*
4. Sushma Bhattarai, Forest Resources and Veterinary Medicine, *Landowners' Preference for Chronic Wasting Disease Management*

Oral Session 2

1 PM – 1:45 PM

Room 1200

Moderator: Grace Olaitan

Evaluators:

1. Sathish Samiappan, Engineering;Agriculture and Life Sciences
2. Kathleen Olivieri, Education, Arts and Sciences, and Business; Engineering
3. Chaomin Luo, Engineering

Participants:

1. Ahmed Manavi Alam, Engineering, *Microwave Radiometer Calibration Using Deep Learning with Reduced Reference Information and Two-Dimensional Spectral Features*
2. Walaa Al-Qwider, Engineering, *Enabling Coexistence Between Aerial and Ground Base Stations: A Traffic-Driven Scheduler, Power Control, and 2D Placement Design Using Deep Reinforcement Learning*
3. James Huston Rogers III, Engineering, *Sensor-Based Multi-Waypoint Autonomous Robot Navigation with Graph-Based Models*

Oral Session 3

1:30 PM – 2:45 PM

Room 1200

Moderator: Emmanuel Oladejo

Evaluators:

1. Snow Xu, Education, Arts and Sciences, and Business
2. Godfred Inkoom, Engineering
3. Miguel Munoz, Arts and Sciences, and Business

Participants:

1. Ana Maria Valencia, Education, Arts and Sciences, and Business, *Comparison of initiators towards the synthesis of degradable Poly(styrene-co-acetal) from bio-based precursor*
2. Gustavo Munoz, Education, Arts and Sciences, and Business, *Interfacial Reaction of Hexafluoroacetone Hydrate: Synthesis of 6F Polymers for High-Performance Applications*
3. Nirosh Udayanga, Education, Arts and Sciences, and Business, *Ru(II)-Catalyzed Transient Directing Group-Assisted Intermolecular Asymmetric Hydroarylation of Bicycloalkenes*
4. Rita Gyawu, Education, Arts and Sciences, and Business, *How Calcium Influences the Start of a Heartbeat*
5. Tanveer Shaikh, Education, Arts and Sciences, and Business, *Precision Control of Nanoparticle Behavior with Engineered Biomimetic Protein Coronas*

Oral Session 4

2 PM – 3 PM

Room 2180

Moderator: Jesse Weaver

Evaluators:

1. Jean-Francois Gout, Agriculture and Life Sciences; Education, Arts and Sciences, and Business; Engineering
2. Ayoung Kim, Education, Arts and Sciences, and Business; Agriculture and Life Sciences

Participants:

1. Sarah Patterson, Education, Arts and Sciences, and Business, *Investigating the impact of transcription on mutation rates*
2. Ncomiwe Andile Maphalala, Agriculture and Life Sciences, *Evaluation of Soybean (Glycine max) seeds' inoculation with Rhizobium japonicum and plant growth promoting Rhizobacteria (PGPR) on yield and soil microbial properties: An herbicide carryover perspective*
3. Jacob Hurwitz, Education, Arts and Sciences, and Business, *WHY WE SHOULD NORMALIZE DATA: EXPLORING DIVERSE TECHNIQUES FOR DATA NORMALIZATION*

Oral Session 5

3 PM – 4 PM

Room 2130

Moderator: Chasity Robertson

Evaluators:

1. Fernando Yamamoto, Forest Resources and Veterinary Medicine; Agriculture and Life Sciences
2. Dayna Emrick, Education, Arts and Sciences, and Business

Participants:

1. Sujita Balami, Forest Resources and Veterinary Medicine, *Development and Evaluation of Live-Attenuated Vaccine Candidates Against Edwardsiella piscicida in Blue (Ictalurus furcatus) x Channel Catfish (Ictalurus punctatus) Hybrids*
2. Suman Pradhan, Forest Resources and Veterinary Medicine, *Enhancing Rolling Shear Performance of Southern Yellow Pine Cross-Laminated Timber (CLT) through Densification.*
3. Shuaib Mubarak, Forest Resources and Veterinary Medicine, *Wood Flame Retardancy Enhancement through Phytic Acid Encapsulation in Water-in-Oil Pickering Emulsion Stabilized by Cellulose Nanofiber.*
4. Mercy Ogunruku, Forest Resources and Veterinary Medicine, *Evaluating Selected Properties of Underutilized Hardwood Species for Fabrication of Cross-Laminated Timber Industrial Mats*

Oral Session 6

3 PM – 4 PM

Room 1200

Moderator: Rohini Maram

Evaluators:

1. Sathish Samiappan, Engineering; Agriculture and Life Sciences
2. Kathleen Olivieri, Education, Arts and Sciences, and Business; Engineering
3. Chaomin Luo, Engineering

Participants:

1. Abdur Rahman, Engineering, *Prediction of Genotype and Phenotype Association Using Image Based Encoding*
2. Mahathir Mohammad Bappy, Engineering, *Parameter Optimization for Accurate and Repeatable Manufacturing of 3D Printed Composite Bone Scaffolds*
3. Clark Hensley, Engineering, *ODBPlotter: Open Source Improvements in Data Processing and Visualization for Wire Arc Additive Manufacturing*
4. Ashreet Mishra, Engineering, *Heat transfer enhancement in particle-based heat exchangers*

Oral Session 7

3 PM – 3:45 PM

Room 1220

Moderator: Patricia Cordero-Irizarry

Evaluators:

1. Anastasia Elder, Education, Arts and Sciences, and Business
2. Sareh Karami, Education, Arts and Sciences, and Business

Participants:

1. Shundrell McMullan, Education, Arts and Sciences, and Business, *Riding with My Sis 'n Nem: Increasing Protective Factors for Black Girls*
2. Joseph Newell, Education, Arts and Sciences, and Business, *Endearment and Infantilization in A Room with a View*
3. Oscar D. Ramirez Perez, Education, Arts and Sciences, and Business, *Not so fast! Investigating the effects of increasing playback speed of video lectures on learning*
4. Segun M. Adeyemo, Forest Resources and Veterinary Medicine, *Habitat Suitability Modeling: A Tool for Restoring Butternut, Juglans Cinerea L., in the Eastern United States.*

Presenters and Abstracts

MISSISSIPPI STATE UNIVERSITY

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Presenter: Niyati Chokshi

Level of Study: PhD

Category: Engineering

Advisor: Dr. Davy Belk

Title: Slender Body aerodynamics instability at high-speeds and high angles of attack

Abstract: The research is on the finding instabilities created around a slender body in air traveling at speeds ranging from March 0.6 to 3 and high angles of attack. Computational fluid dynamics approach is used to stimulate conditions and results are then post processed to visualize the side forces and vortices created.

Presenter: Aditya Shah

Level of Study: PhD

Category: Engineering

Advisor: Dr. Rani Sullivan (Professor, Head of Department of Aerospace Engineering)

Title: Stitched composites for damage tolerant aerospace structures

Abstract: Composite structures are widely used in the aerospace industry due to their excellent mechanical properties and high strength-to-weight ratio. Composites are also highly tailorable and offer unmatched design potential compared to traditional metals. Recent advancements in composite manufacturing techniques have enabled the development of highly unitized concepts such as the Pultruded Rod Stitched Efficient Unitized Structure (PRSEUS). PRSEUS takes advantage of composite materials' excellent directional properties and stitching as a means of through-thickness reinforcement and damage arrestment for manufacturing stiffened unitized structures . This unitized manufacturing approach enables manufacturing of complex shapes and geometries while keeping the part count low . The highly integrated nature of the PRSEUS structure creates an opportunity for fiber tailoring and design optimization. However, current composite design optimization techniques are often limited to fiber arrangements and stacking sequences of the laminates due to a lack of robust progressive damage analysis tools. A structure manufactured using the PRSEUS concept can have complex shapes at various structural levels.

Presenter: Rejane S. Paulino

Level of Study: PhD

Category: Engineering

Advisor: Dr. Vitor Souza Martins (Department of Agricultural & Biological Engineering (ABE))

Title: Monitoring of cyanobacteria blooms in tropical urban reservoirs using remote sensing

Abstract: Cyanobacteria involves aquatic algae with cyanotoxins. Toxic cyanobacterial blooms occur worldwide and affect especially the urban reservoirs. These environments are sensitives to cyanobacteria blooms due to pollution and anthropogenic nutrient inputs (e.g., nitrogen and phosphorus). Due to their toxin compounds and acute and chronic intoxication events, cyanobacteria blooms have been severely investigated and remote sensed data can help to identify these events. Waterbodies can be monitored by remote sensing data with high quality spatial and spectral and daily revisit. These characteristics allow to monitor bloom events in local-, regional- and global-scales with temporal correlation. In this study, the occurrence of cyanobacteria blooms has been investigated in two tropical urban reservoirs located in Brazil. The Spectral Shape (SS) algorithm was used to identify cyanobacteria blooms in both reservoirs. It is based on spectral response of cyanobacteria in the spectral domains at 620-, 665-,681-, and 709-nm. Images of 300 m OLCI sensor, onboard of Sentinel-3 satellite, in surface reflectance level, were used to apply the SS algorithm. In-situ radiometric data collected with field sensors were used to validate the OLCI image reflectance and SS values, and in-situ taxonomy data were used to validate the correlation between SS and cyanobacteria blooms. Results indicated that 300 m OLCI provided a robust estimate of cyanobacteria blooms in tropical urban reservoirs. The cell counts of cyanobacteria versus SS algorithm was well-correlated. Therefore, the results suggest that remote sensing data aligned with SS algorithm are feasible for monitoring tropical reservoirs containing cyanobacterias.

Presenter: Chamika A. Silva

Level of Study: Master's

Category: Engineering

Advisor: Dr. Nuwan K. Wijewardena

Title: Can the moisture impact on VisNIR and MIR spectra be mitigated to calibrate robust predictive models for soil properties?

Abstract: Spectroscopic analysis of soil using visible-near infrared (VisNIR) and mid infrared (MIR) region is a rapid and nondestructive approach. Soil moisture is the most significant limiting factor to use this technology in the field. The objective of this study was to understand the moisture impact on different spectral regions and explore strategies to mitigate enabling the development of in-situ soil sensors. The study compared three correction approaches: Direct Standardization (DS), External Parameter Orthogonalization (EPO), and Spiking with extra-weights, to estimate six soil properties. Spectra were collected using three spectrometers operated in either VisNIR or MIR region which also included both portable and lab-scale instruments. A total of 473 soil samples collected from 36 different benchmark soil series were freshly scanned and then air dried, ground and sieved to obtain <2mm fractions. Out of these, 272 samples were used to develop dry ground models with partial least square regression (PLSR) modeling. The remaining 201 samples were rewetted to nine moisture levels and scanned. One hundred of these samples were used to implement calibration transfer and the rest were used as the validation set. The results showed that the MIR spectra were significantly affected by the moisture. The influence depended on the mode of spectral acquisition. Diffuse reflectance spectra had more complex moisture impact compared to attenuated total reflectance spectra. Spiking with extra-weights outperformed other techniques (EPO and DS) and improvements were consistent across different moisture levels. With spiking, Calcium showed the highest improvement with an increase in R2 from 0.04 for no correction to >0.83 and an RPIQ (ratio of performance to interquartile range) from 0.45 to > 2.0. DS displayed satisfactorily improvements within VisNIR region but had the highest variability across different moisture levels. Unlike DS and Spiking, EPO performances were deteriorated with the increasing moisture and the corrections were mostly property and spectral region dependent. Study concluded that spiking can be used as a reliable and robust approach for moisture correction for in-situ soil spectroscopic applications.

Presenter: Yasas Gamagedara

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Nuwan Wijewardane, Department of Agricultural and Biological Engineering

Title: Investigating the feasibility of using mid-infrared fine-ground soil spectra to predict non-fine-ground soil spectra

Abstract: Mid-infrared (MIR) reflectance spectroscopy emerges as a highly promising and expeditious technology for the precise estimation of soil properties. One challenging problem in this process is the labor-intensive and time-consuming nature of fine-grinding soil samples, a step that significantly influences spectral features and subsequent multivariate model calibrations. The innovative idea lies in leveraging pre-existing fine-ground spectral libraries to estimate soil properties in new non-fine-ground samples, thereby avoiding the need for fine-grinding. There have been no reports of successful attempts to predict non-fine-ground spectra using existing fine-ground spectral libraries. To bridge this research gap, this study investigated different calibration transfer and pre-processing techniques to link MIR fine-ground spectral models with non-fine-ground soil spectra. Four distinct calibration transfer methods: direct standardization (DS), external parameter orthogonalization (EPO), slope/bias correction (SB), spiking, and four pre-processing techniques: first derivative, detrending (DT), multiplicative signal correction (MSC), and standard normal variate (SNV) were examined. This investigation was carried out using the extensive spectral library maintained by the United States Department of Agriculture (USDA) National Soil Survey Center Kellogg Soil Survey Laboratory, encompassing over 70,000 samples. A randomly selected subset consisting of 519 samples, each associated with 12 soil properties: inorganic carbon, organic carbon, total carbon, total nitrogen, total sulfur, cation exchange capacity, pH, potassium, phosphorous, clay, silt, and sand was used as the local spectral dataset. The outcomes reveal that, with the exception of spiking, none of the calibration transfer or pre-processing techniques consistently improved the performance across all soil properties examined. This implied that spiking offers a promising method for applying existing MIR fine-ground soil spectral libraries on new samples without fine-grinding, ultimately yielding substantial savings in both cost and time.

Presenter: Dakota James Hester

Level of Study: PhD

Category: Engineering

Advisor: Vitor S Martins - Assistant Professor - Department of Agricultural and Biological Engineering

Title: Semi-supervised Land Cover Classification of High Spatial Resolution Aerial Imagery with Contrastive Deep Learning

Abstract: Land cover classification is among the most common tasks in remote sensing data analysis. While land cover classification is often performed on medium spatial resolution data (30m ground sampling distance) using pixel-based machine learning algorithms, there is an increasing interest in large-scale high spatial resolution mapping, especially with more <5m satellite and aerial imagery. However, pixel-based methods for land cover classification are not as effective at high resolution due to increased intra-class variance, noise, and image artifacts not present in medium-resolution data, and convolutional neural networks (CNNs) are a viable alternative due to their sensitivity to spatial and texture information but require large amounts of annotated training data to achieve high accuracy under a fully supervised training schema. To alleviate the need for large amounts of training data, we propose a semi-supervised approach to training CNNs for land cover classification using contrastive learning with unannotated data. In this training schema, a ResNet CNN is trained using a SimCLR procedure to maximize the similarity between latent embeddings of different augmentations of the same scene, while minimizing the similarity between embeddings of augmentations from differing scenes. During the fine-tuning stage, a limited number of annotated samples are used to train a DeepLabv3+ semantic segmentation decoder using embeddings from the pre-trained ResNet CNN. Preliminary results show that these embeddings produced with self-supervised learning (SSL) improve model performance compared to using an encoder pre-trained in a fully supervised schema using ImageNet-1k data. Further, the SSL pre-training procedure is task-agnostic with respect to the downstream problem, allowing the encoder to be implemented in a wide variety of remote sensing tasks, such as scene classification,

Presenter: Sabina Regmi

Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Dr. Ayoung Kim, Assistant professor, Department of Agricultural Economics

Title: Unveiling Broadband Adoption Disparities in Mississippi: Urban-Rural and Income Group Analysis

Abstract: Access to broadband internet (currently defined by the Federal Communications Commission (FCC) as internet with at least a 25 Mbps download and a 3 Mbps upload speed) is essential to modern life. Broadband empowers communities, fosters employment growth and business opportunities, improves civic engagement and political participation, and enhances public education. In 2021, 78% of Mississippi households had broadband subscriptions, and 53% subscribed to high-speed broadband through fixed cable, fiber, or DSL connections. The overall broadband adoption rate in Mississippi is on the rise. However, the digital divide persists in Mississippi in broadband adoption across demographic, socioeconomic, and geographic groups. Rural regions exhibit a lower broadband subscription rate of 69.6% compared to 84.5% in urban regions (61.9% in urban and 37.7% in rural for high-speed broadband). For households earning below 20k annually, the broadband subscription rate is 56.5%, a notable contrast to the rate of 91.5% for households with an annual income of $75,000 or more. The digital divide can exacerbate existing inequalities by constraining lagging communities' access to education, employment, and healthcare opportunities. Addressing these disparities through broadband adoption is pivotal in promoting economic development in underserved communities and reducing socioeconomic inequalities among lower-income and minority households. This study aims to explore broadband adoption in Mississippi by utilizing data from the American Community Survey (ACS) from the U.S. Census Bureau. The research will analyze broadband internet subscriptions among households and assess the variation in broadband adoption by urban-rural status and among income groups in Mississippi. By highlighting the status of broadband adoption, we can understand the severity of the disparities, identify specific groups or regions that require assistance, and further explore potential barriers that hinder their adoption. This foundational understanding can pave the way for further policy discussions on devising effective strategies to bridge the gap and promote digital inclusion for all.

Presenter: Emmanuel Oladejo

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Shengfa Liao

Title: Effects of supplementation of DL-Met on serum and liver antioxidant status of oxidatively stressed growing pigs

Abstract: Oxidative stress impairs the redox status of the pig which is detrimental to its health ang growth. This study investigates the effects of supplementing more DL-Met on the antioxidant status in oxidatively stressed growing pigs. Forty barrows were randomly allotted to 4 treatment groups. While Groups 1 and 2 received a basal diet (D1), Group 3 received a DL-Met supplemented diet (D2) containing 125% SID Met+Cys of D1. After 21 days of feeding, pigs were injected with either 10 mL saline (for Group 1) or 10 mg/kg-BW diquat in 10 mL saline (for Groups 2 and 3). On days 0, 22 and 29, blood samples were collected and processed for serum, and liver tissue samples were collected on day 29 when the pigs were harvested in a meat laboratory. Measurement of serum and liver antioxidative status were conducted via the analysis of several enzymatic antioxidants such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GSH-Px), and the total antioxidant capacity (TAC) as well. Data was analyzed using the PROC GLM of SAS software (v. 9.4). In the serum, GSH-Px concentration was reduced ($P<0.05$) in Group 2 relative to Group 1 but significantly elevated ($P<0.0001$) with more DL-Met. Also, TAC in the serum tended to be lowered ($P=0.1$) in Group 2 relative to Group 1 but was elevated ($P=0.05$) in Group 3 relative to Group 2. In the liver, SOD concentration was lowered ($P<0.05$) in Group 2 relative to Group 1 but tended to increase ($P=0.08$) with more DL-Met. Also in the liver, GSH-Px tended to decrease ($P=0.09$) in Group 2 relative to Group 1 but was elevated ($P<0.05$) with more DL-Met. In conclusion, more DL-Met supplementation enhanced the serum and liver antioxidative capacity of the oxidatively stressed pigs.

Keywords: oxidative stress, DL-Met, antioxidant, serum, liver, pig

Presenter: Rezwana Rahman Setu

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. George Popescu, Research Assistant Professor, Department of BCH-EPP and Institute for Genomics, Biocomputing and Biotechnology, Mississippi State University.

Title: Analysis of Systemic Acquired Resistance by Monitoring Redox-Mediated Transcriptional Dynamics in Arabidopsis

Abstract: In plants, systemic acquired resistance (SAR) provides long-lasting broad-spectrum protection against pathogens through a priming mechanism involving redox and phytohormonal signaling. However, there is limited knowledge regarding transcriptional dynamics during SAR onset and the redox involvement in SAR maintenance. Our previous work has identified several key genes to understand the regulatory dynamics of SAR onset. Here we investigate these dynamics by analyzing the transcriptional activity of GRXS13 (Glutaredoxins, At1g03850), a disease resistance-related CC-type GRX strongly inducible by SA. To track these dynamics, we fused a luciferase reporter gene to the promoter region of GRXS13, by gateway cloning. We transformed A. thaliana wild-type Columbia ecotype (Col-0) and the SAR-defective top2 mutant plants with this GRXS13 reporter construct using Agrobacterium-mediated floral dip transformation. We infiltrated T1 generation plants with Pseudomonas syringae pv. tomato DC3000 expressing avrRPT2 to prompt SAR. Promotor transcriptional activity was then tracked by monitoring bioluminescence at two-hour intervals after infection for the duration of four days in 12 h light and 12 h dark diurnal cycles. We observed oscillatory dynamics of the GRXS13 expression in planta during SAR onset and compared it with the transcriptional response of SAR driver genes previously identified. Comparative analysis of GRXS13 dynamics in Col-0 and the top2 mutant provides insights into how dysregulated redox signaling affects SAR onset. In the future, we plan to analyze the transcriptional dynamics of a larger set of SAR marker genes to further understand the role of redox signaling in plant immunity.

Presenter: Lauren Jennings

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Priyadarshini Chakrabarti Basu, Assistant Professor, Department of Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Title: Developing a Pollen Nutrition Database for North America

Abstract: Poor nutrition is one of the major stressors of bee species and is a main contributor to loss in pollinator populations. Bees are currently faced with many nutritional challenges, including loss of forage habitat and monoculture. The aim of this project is to promote better nutrition for bees by learning which floral resources are nutritionally optimal for all bees based on the nutritional composition of their pollens. This study first uses various methods of pollen collection in order to collect sufficient pollen from each target species of plants. Next, the collected pollen samples are analyzed in the lab using basic biochemical assays, as well as mass spectrometry-based methods, to determine the nutritional quality of the pollen. The pollen is analyzed for its concentration of proteins, lipids, amino acids, sterols, metabolites, and phytochemicals. Finally, all of this data collected will be compiled into an online database showcasing the nutritional quality of each plant species' pollen. This database can be used by beekeepers, conservation groups, researchers, growers, and policymakers to scientifically select forage plants for bee pollinators.

Presenter: Urita Agana

Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Priyadarshini Chakrabarti Basu

Title: Honey Bee Physiology and Gut Microbiome Diversity Along an Agricultural Intensification Gradient

Abstract: Honeybees (Apis mellifera L.) are the major insect pollinators of many different crops. A drastic decline in the honey bee populations has been reported over the past decade. While many factors have contributed to this decline, pesticides, poor nutrition, and Varroa mites are the most common concerns noted by scientists and beekeepers. Aside from direct toxicity from pesticides, it has been observed that sublethal pesticide doses have effects on honey bee physiology and behavior such as oxidative stress, disruption of foraging and homing, olfactory inhibition and changes to honey bee neurophysiology. In addition, poor nutrition makes honey bees more susceptible to pesticide stress, parasites and pathogens and disrupts their ability to overwinter. The primary objective of this study is to examine the impacts of field realistic pesticide exposures and poor nutrition on honey bee gut microbiome diversity and individual bee physiology. In this study, 16 honey bee colonies were placed in each of the four different locations (Stoneville, Greenwood, Macon, and West Point) across Mississippi along an agricultural intensification gradient and with varying degrees of natural forage availability. Pollen and honey samples have been collected from these field sites to analyze for pesticides residues. In addition, live honey bees have been sampled for physiological assays and gut microbiome analysis. The experiment is currently ongoing, and the information gleaned from the results will reveal valuable insight about the interactions between these two stressors and their impacts on honey bees under field conditions.

Presenter: Sarah Patterson

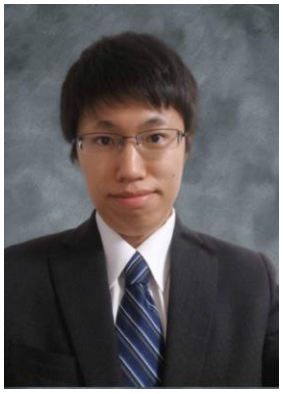
Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Jean-Francois Gout, Department of Biological Sciences

Title: Investigating the impact of transcription on mutation rates

Abstract: tRNA genes are highly transcribed and perform one of the most fundamental cellular functions. Although a universal pattern observed across all three domains of life is that highly transcribed genes tend to evolve slowly, tRNA genes have been shown previously to evolve rapidly. This rapid sequence evolution could result from relaxed selection, increased mutation rate, or a combination of both. Here, we use mutation-accumulation line sequencing data to show that tRNA genes accumulate more mutations than other gene types. Our results indicate that this elevated mutation rate is a consequence of both elevated transcription-associated mutagenesis and a lack of transcription-coupled repair in tRNA genes. We also identify the gene Msh2 as being involved in transcription-coupled repair.



Presenter: Riku Kikuta

Level of Study: PhD

Category: Engineering

Advisor: Dr. Daniel Carruth, Associate Research Professor, Center for Advanced Vehicular Systems

Title: Risk assessment and observation of driver with pedestrian using instantaneous heart rate and HRV

Abstract: Currently, human drivers outperform self-driving vehicles in many conditions such as collision avoidance. Therefore, understanding human driver behaviour in these conditions will provide insight for future autonomous vehicles. For understanding driver behaviour, risk assessment is applied so far as one of the approaches by using both subjective and objective measurement. Subjective measurement methods such as questionnaires may provide insight into driver risk assessment but there is often significant variability between drivers. Physiological measurements such as heart rate (HR), electroencephalogram (EEG), and electromyogram (EMG) provide more objective measurements of driver risk assessment. HR is often used for measuring driver's risk assessment based on observed correlations between HR and risk perception. Previous work has used HR to measure driver's risk assessment in self-driving systems, but pedestrian dynamics is not considered for the research. In this study, we observed driver's behaviour in certain scenarios which have pedestrian on driving simulator. The scenarios have safe/unsafe situations (i.e., pedestrian crosses road and vehicle may hit pedestrian in one scenario), HR analysis in time/frequency domain is processed for risk assessment. As a result, HR analysis in frequency domain shows certain reasonability for driver risk assessment when driver has pedestrian in its traffic.

Presenter: Ana Maria Valencia

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Colleen Scott, Chemistry

Title: Comparison of initiators towards the synthesis of degradable Poly(styrene-co-acetal) from bio-based precursor

Abstract: Polystyrene (PS) is a major commodity polymer used globally for packaging and insulation due to its low cost, insulation, chemical durability, and ease of manufacturing. However, like many of our commodity plastics, PS persists in the environment indefinitely after disposal, contributing to the waste accumulation problem. For this reason, there is a need to design degradable polymers to address the environmental pollution problem. An additional problem is our reliance on petrochemical for our precursors. With the volatility in the cost of petroleum, there is a need for more reliance on stable feedstock to obtain the precursors. Consequently, biomass is a sustainable and inexpensive feedstock that is highly appropriate for designing degradable thermoplastics. One approach is to design degradable polymers with hydrolytic acetal groups that could undergo degradation in an efficient method. In this research, we focus on the synthesis of PS from biomass with a hydrolytic acetal group. In this way, the introduction of acetal groups would improve the degradability of the polymer and the products of this degradation will not cause damage to the environment.

PS can be prepared by thermally initiated free-radical polymerization reaction, using common initiators such as azobisisobutyronitrile (AIBN) and benzoyl peroxide (BPO). However, polymers obtained with these initiators showed low molecular weight, and the crosslinking obtained by this method was low. For this reason, a new initiator was tried to improve the molecular weight of the polymer and the crosslinking yield. The use of novel radical initiators such as polyaniline (PANI) was proposed. In this presentation, we will report on the synthesis and characterization of an acetal containing PS by using two different initiators, with the aim to compare the best-crosslinked product and its possibility to undergo degradation.

Presenter: Taofiq Abdulrahee

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Amanda L. Patrick (Chemistry department)

Title: Gas-phase dissociation and thermal decomposition study of ionic liquids: Focusing on 1-butyl-3-vinyl imidazolium chloride

Abstract: Ionic liquids (ILs) are a class of compounds comprising cations and anions that have relatively low melting point (when compared to typical salts) due to their typically bulky, asymmetric cations. These compounds often have favorable properties such as thermal stability, electrical conductivity, and a wide liquid range. Importantly, properties can be tuned by altering various parameters such as anion, cation scaffold, and cation substituents to produce task-specific ILs. ILs have been proposed for many high-temperature applications including as solvents, high-temperature lubricants, and stationary phases of gas chromatography columns. An understanding of IL stability and degradation pathways can help to match ILs with tasks based on temperature range, contribute toward our ability to predict stability based on structure of hypothetical ILs, and allow us to determine potential contaminants and breakdown products from prolonged use at elevated temperatures. Furthermore, knowledge about the decomposition temperature, products, and mechanisms of ionic liquids provides information about the safe use and recycling of these compounds and their fates if released in the environment.

In this study, our aim is to understand the thermal stability, thermal decomposition, and gas-phase dissociation of ionic liquids using thermogravimetric analysis (TGA), pyrolysis-gas chromatography-mass spectrometry (Py-GC-MS), and electrospray ionization-mass spectrometry (ESI-MS) techniques. Specifically, the goal is to gain an understanding of how molecular-level insights might lead to understanding bulk level stability and decomposition properties. This presentation will focus on 1-butyl-vinylimidazolium chloride as a case study. In the course of the presentation, the gas-phase dissociation products, thermal decomposition products, and the associated mechanisms will be discussed. Moreover, the gas-phase dissociation and thermal decomposition products will be compared. This case study will be contextualized within the broader scope of the overarching goal of this project.

Presenter: Jayamini Hewage

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: David Wipf

Title: High surface area rice husk biochar for supercapacitor electrodes

Abstract: The escalating global energy consumption has compelled scientists to seek sustainable and renewable energy sources. Supercapacitors, with their fast charging and discharging capabilities, coupled with a long lifespan, have emerged as useful high-power delivery reservoirs for mobile devices, electric vehicles, and other rechargeable energy storage devices. Carbon-based materials are frequently considered as supercapacitor electrode due to its low cost and potentially high conductivity. Here, rice husk biochar is used as the carbon source. Its surface area was increased by soaking the dried rice husk in ZnCl2 solution followed by pyrolysis at 400 °C and washing to form the biochar. The resulting modified biochar was characterized with SEM, X-ray diffraction, and elemental analysis. The surface area and pore volumes were analyzed by the Brunauer–Emmett–Teller method. ZnCl2-modified biochar was compared with unmodified rice husk biochar by cyclic voltammetry analysis and galvanostatic charge-discharge profiling. Cyclic voltammograms of the ZnCl2-modified biochar indicate the rectangular shape expected for EDL (electrical double-layer) supercapacitors. The ZnCl2-modified biochar electrodes showed a high specific capacitance of 19.03 F g-1 and demonstrated stable operation over 100 charge-discharge cycles.

Presenter: Rita Gyawu

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Christopher Johnson

Title: How Calcium Influences the Start of a Heartbeat

Abstract: A healthy heart requires rhythmic beating to pump blood throughout the body. Within each cardiomyocyte, sodium ion channels generate electricity that initiates the contraction process. Inappropriate or untimely sodium channel function can cause or contribute to life-threatening disease (arrhythmia). In addition to signaling cardiac contraction, changes in calcium concentration can modify sodium channel function. How calcium alters cardiac sodium channel function has been the subject of extensive investigation, however, a detailed description of this process that reconciles all available data remains to be determined. Understanding this mechanism is critical for developing novel treatment and management practices for those suffering from sodium channelopathy mediated disease.

Here we use a combination of NMR, molecular modeling, and patch clamp electrophysiology to understand how the human cardiac sodium channel (NaV1.5) changes its function in response to changes in calcium concentration.

Using NMR we dissect how components of the sodium channel C-Terminal Domain (CTD) interacts with themselves, as well as the calcium sensing protein calmodulin. Using molecular dynamics, we developed an in-silico model of a full-length sodium channel (in a lipid membrane with explicit solvent) to gain insight into how these interactions participate and function within an intact ion channel. Using electrophysiology, we evaluate our models of calcium modification. We find that in solution the IQ motif cannot simultaneously interact with the CTD and Calmodulin. This contrasts with crystallographic models where CaM and the CTD engage the IQ motif as a trimeric complex. Moreover, CaM is a better "thief" of an IQ motif peptide in the presence of calcium. This is of particular interest as an opposite effect has been observed for sodium channels in the brain. Together our results provide mechanistic insight into how calcium alters the function of the cardiac sodium channel.

Authors: Torien M. Beard, Garrett M. Knotts, MNA Afsar, Taylor A. Agee, Jarrod A. Smith, Brett Koroncke, and Christopher N. Johnson

Presenter: Olufemi Ademola Farotimi

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Amanda Patrick(Chemistry)

Title: Hydrogen/Deuterium Exchange Predictions as an Approach to Winnow the Possible Isomer Identities of Metabolite Features in Mass Spectrometry

Abstract: The detection, identification, and quantitation of metabolites is a key application of mass spectrometry tools to biological questions. Typically, chromatographic retention time, precursor mass-to-charge ratio, and fragmentation patterns are used to identify metabolomics "features" whose increase or decrease correspond to changes in biological or health state. Once identified, such features may be useful as biomarkers of disease or other conditions. However, translating the experimental data to a chemical structure is often a bottleneck. A given mass-to-charge ratio may be associated with numerous isomers and isobars (molecules with the same nominal mass), which makes it difficult to assign a specific chemical structure to a formula.

Many approaches have been posited for metabolite identification, including NMR spectroscopy, infrared ion spectroscopy, and alternative dissociation methods. These approaches however have various disadvantages. Having an approach nested within the mass spectrometry experiment that does not require additional instrumentation would be an attractive approach toward narrowing the possible isomers contributing to a given feature. Consequently, various approaches to isotopic labeling have been reported in the literature toward isomer differentiation. Hydrogen/deuterium exchange (HDX) is prominent due to its ease of implementation and the selective nature of ambient exchange at certain functional groups such as -OH, -SH, -COOH, -NH. Previous reports have focused on in-source kinetic HDX or gas-phase HDX, which often faces the challenges of incomplete exchange. Such a temporally dependent exchange offers a richer isomer differentiation but limits the ability to make predictions without experimental standards.

The focus of our project is to (1) perform a literature search (and any necessary experimental validation) summarizing the identities of exchangeable protons for a given set of experimental exchange conditions, (2) determine the power of number of exchangeable protons as an orthogonal data point for narrowing down candidate metabolite structures (based on entries in the Human Metabolome Database (HMDB)), and (3) evaluate potential approaches to integrating complete exchange and database comparison into metabolomics workflows. This talk will provide an overview of the motivation for this work, the approach to be taken, and an update on the initial results obtained toward these objectives.

Presenter: Arma Regmi

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. David O. Wipf, Department of Chemistry

Title: Increased cathode capacity of the Ni-Fe battery using sulfide addition

Abstract: An aqueous rechargeable nickel-iron battery is a promising candidate for grid-scale energy storage because of its safety, higher energy density, and low cost. However, implementation has been limited due to poor cycle performance and conductivity. The addition of sulfide provides improved theoretical specific capacity and cycle life of Ni-Fe batteries. In this study, we developed a method to fabricate Ni electrodes which exhibit a higher capacity and increased cycle life. In this method, Ni powder is inductively heated to sinter it into a robust, porous pellet. This pellet is treated with thioacetamide solution as a sulfide source under ambient conditions forming a NiSx surface layer on the pellet. In testing with an aqueous alkaline electrolyte, the electrode performed without a major change in specific capacity for over 1500 redox cycles. Based on galvanostatic charge-discharge experiments, the areal-specific capacity is 1.55 mAh cm-2. The electrode is highly stable and robust throughout the cycling and characterization processes. These results suggest a simple and effective method of electrode fabrication that can be used as a cathode for high volumetric energy density and power density Ni-Fe batteries.

Keywords: Ni-Fe battery, sulfide additives, high energy density, high power density

Presenter: Gustavo Munoz

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Dennis W. Smith, Jr. Department of Chemistry

Title: Interfacial Reaction of Hexafluoroacetone Hydrate: Synthesis of 6F Polymers for High-Performance Applications

Abstract: Semi-fluorinated polymers containing main-chain 1,1,1,3,3,3-hexafluoroisopropylidene (6F) linkages exhibit unique characteristics due to the strong C-F bond and the free volume provided by this group. In most cases, the presence of the 6F group increases thermal stability, glass transition temperature (Tg), and solubility, fundamental properties to develop processable high-performance materials. Polyhydroxyalkylation is a method used to produce linear polymers with high thermal stability and processability. This method involves polymerizing an array of aldehydes and ketones with aromatic monomers. Semi-fluorinated ketones, such as 2,2,2-trifluoroacetophenone, have been successfully used to create high-performance materials. However, the polymerization of perfluorinated ketones, like hexafluoroacetone (HFA), using this approach has been challenging due to their reduced reactivity in generating electrophilic species capable of forming macromolecules. The only prior work on the polymerization of HFA with diphenyl ether was presented in a DuPont patent over sixty years ago, and it involved extremely harsh conditions. In this study, a versatile, straightforward, and cost-effective strategy for incorporating the 6F group into polymers is presented. The interfacial Friedel-Crafts polymerization of hexafluoroacetone trihydrate (HFAH) with various activated and non-activated aromatic monomers allows us to synthesize semi-fluorinated polyaryl ethers and polyphenylenes with moderate to high molecular weights, low branching, and high thermo-oxidative stability. The polymers obtained exhibit Tg values ranging from 157 to 250 °C. These materials also exhibit high transmittance throughout the visible region and have dielectric constant values comparable with commercial low dielectric polymers. They hold significant potential for applications in extreme environments, such as the automotive and aerospace industries, and are particularly appealing for gas separation technologies.

Presenter: Chathuri Peiris

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Todd Mlsna , Professor, Department of Chemistry

Title: Metal Cation-Induced Surface Nanoengineering of Lignin-Enriched Softwood and Hardwood Fibers for Sustainable and Water-Resistant Food Packaging.

Abstract: The increasing environmental concerns have led to a surge in the demand for eco-friendly and biodegradable food packaging, coinciding with a decline in the utilization of plastic tableware. In this research, we employed the metal cation-induced surface nanoengineering technique (Mx+ -SNE) to treat both softwood and hardwood lignocellulosic fibers. This involved immersing the fibers in aqueous metal ion solutions and subsequently drying them to improve water resistance and wet tensile strength. Metal cations (MX+) such as Fe3+ and Zr4+, are capable of coordinating with fiber polar groups (i.e., -OH, C=O, and COOH), causing the surface "hairy" cellulose nanofibrils to self-assemble into a more compact structure by reducing exposed hydroxyl groups to moisture. This leads to reduced surface energy and a notable enhancement in hydrophobicity and water resistance. The wettability transition of the fibers was analyzed by measuring water absorption capacity, water contact angle (WCA), and dry and wet tensile strength. The wettability transition of lignocellulosic fibers was evaluated by measuring water contact angle (WCA), water absorption capacity, and dry and wet tensile strength. Upon treatment with Zr+ solution, for 4 h, softwood lignocellulosic fibers' WCA experienced a notable increase to 130 °. However, the WCA was increased only up to 125◦ after immersing the softwood fiber in a Fe3+ solution for 4 h. This, Mx+ -SNE technique can be considered as a simple and novel alternative route for developing sustainable and biodegradable bio-based tableware.

Presenter: Hari Giri

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Colleen Scott

Title: Phenothiazine-based polyaniline derivative: Effects of side-chain, solvent, and dopant on the conductivity

Abstract: Polyaniline (PANI) is a conducting polymer recognized as one of this field's earliest and most significant discoveries. The compound's favorable characteristics, including its ease of synthesis, high electrical conductivity, and environmental durability in the doped state, render it highly appealing for a wide range of potential applications. Nevertheless, the substance's insolubility and limited redox stability have posed significant obstacles for numerous commercial applications. As a result, numerous researchers have endeavored to address the limitations of PANI through various approaches, such as the creation of derivatives of PANI. Phenothiazine is a dye that exhibits redox stability, making it suitable for integration into a polymer matrix to confer redox stability to the resulting material.

Moreover, this technique enables the introduction of a solubilizing moiety onto a nitrogen atom, thereby enhancing the solubility of polymers based on phenothiazine in a wide range of organic solvents. This poster aims to elucidate synthesizing a polymer based on phenothiazine by utilizing the Buchwald/Hartwig cross-coupling reaction, employing p-phenylenediamine as the co-monomer. This study aims to conduct a comprehensive comparative analysis of the impact of dopant concentration, various dopants on the PANI mimic, solvent effect, side chain effect, and substituent effect, employing UV/Vis spectroscopy, a four-point probe as the primary analytical technique. The orientation of the polymer chains influences conductivity.

Presenter: Tanveer Shaikh

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Nicholas C. Fitzkee, Professor, Department of Chemistry

Title: Precision Control of Nanoparticle Behavior with Engineered Biomimetic Protein Coronas

Abstract: Nanoparticles hold significant therapeutic potential, but their interaction with proteins in biological fluids creates a protein corona that affects their in vivo behavior. Predictive models of bio-nano interactions remain elusive, hindering the rapid development of effective nanotherapeutics. In this work, we investigated the mechanistic and biological aspects of corona formation on gold nanoparticles (AuNPs) by tracking the behavior of bovine serum albumin (BSA) in complex protein mixtures. The binding of BSA on AuNPs is confirmed by 1H NMR, UV-vis, and dynamic light scattering (DLS). Serum albumin was isotopically tagged to investigate its binding to AuNPs in the presence of other proteins using NMR. Transferrin (Tf) and Fibronectin (Fn) compete with BSA for binding, while Immunoglobulin G (IgG) does not displace BSA. The presence of Tf and Fn was confirmed by DLS, which also showed IgG aggregates in AuNP presence. A simplified mixture of BSA, Tf, Fn, and IgG produced similar spectroscopic behavior as complete serum, indicating competitive binding in complex mixtures at high protein concentrations. Rapid corona formation was observed using 19F NMR, while circular dichroism revealed altered protein secondary structure for mixtures in the presence of AuNPs. To comprehend the biological significance of protein corona formation on nanoparticle uptake, we explored the cellular uptake of these AuNPs. Surprisingly, AuNPs with engineered corona showed reduced macrophage uptake and increased cancer cell uptake compared to serum-coated AuNPs. These findings underscore the unique contributions of individual serum components to corona formation and suggest that a simplified mixture can effectively replicate aspects of adsorption observed in complete serum.

Presenter: Chibuike Onyeogulu

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Amanda L. Patrick. Department of Chemistry

Title: Reproducibility of drift gas modifier effects in ion mobility spectrometry

Abstract: Mass spectrometry (MS) is an analytical technique that is used in many fields—from clinical analysis to environmental monitoring—to identify and quantify chemical species. Whereas MS has many analytical strengths, including being highly sensitive, it primarily provides the mass-to-charge ratio of the analyte. This makes isomer and isobar (ions with the same nominal mass) differentiation a challenge for mass spectrometric analysis alone. Ion mobility spectrometry (IMS), often coupled to MS, is an analytical method used for gas-phase separation of analyte ions. Since IMS separates ions based on their shape instead of mass, it can be used to differentiate isomers; however, this is often quite challenging with many small molecule isomers, where differences in collisional cross section may be too small to facilitate separation. One approach to improving separations is doping the drift gas with drift gas modifiers (DGMs). Ideally, the DGM would preferentially interact more with one isomer than the other(s), increasing that isomer's drift time relative to the other isomers and allowing for improved selectivity. Previous work with DGMs on custom-made instrumentation has shown that the approach is promising, but some work remains to realize its analytical utility.

The aim of the present study is to investigate whether the previously reported effects can be reproduced on a commercially available instrument and to compare the inter-day and inter-user reproducibility of these effects. High levels of reproducibility are required for DGM use to be broadly useful for analytical applications. Six model analytes were studied: valinol, tryptophan, ethanolamine, atenolol, serine, and salbutamol. Four DGMs were included in the study, specifically ethyl lactate, acetonitrile, trifluoromethyl benzyl alcohol (TFMBA) and 2-butanol. Several instrument conditions (DGM flowrates and drift tube temperatures) were also included in the reproducibility survey. Change in drift time was calculated for each analyte and DGM pair and experimental condition across several replicate measurements; the calculated changes in drift time were then compared to previously obtained data from the literature and other users to characterize reproducibility. Qualitative changes in the spectrum induced by addition of the DGMs will also be discussed.

Presenter: Nirosh Udayanga

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Prof. Xin Cui

Title: Ru(II)-Catalyzed Transient Directing Group-Assisted Intermolecular Asymmetric Hydroarylation of Bicycloalkenes

Abstract: The asymmetric hydroarylation of bicycloalkenes is a highly desirable synthetic methodology, owing to its excellent atom economy and cost-efficiency. Although, the fundamental reactions, such as the Friedel-Craft reaction, yield valuable hydroarylation products, the control of site selectivity and stereoselectivity remains a significant challenge. In pursuit of addressing this issue, our laboratory is actively engaged in the development of a novel approach for ruthenium-catalyzed asymmetric hydroarylation of aldehyde using amine as a chiral transient directing group. A Series of chiral amines has been synthesized and subject to rigorous testing for intermolecular C–H bond activation. Encouragingly, current results demonstrate up to 85% yield and higher enantiomeric excess. The ongoing research efforts in our laboratory are focused on further refining this system and advancing its development.

Presenter: Oluwabori Adekanye

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr Matthew Ross

Title: TRANSCRIPTOMIC ANALYSIS OF CARBOXYLESTERASE 1 (CES1) KNOCKDOWN THP-1 MACROPHAGES AT BASELINE (M0) AND CLASSICALLY ACTIVATED (M1) THP-1 MACROPHAGES REVEAL SIMILAR EXPRESSION SIGNATURES.

Abstract: Macrophages are immune cells derived from hematopoietic precursors, they maintain host defense and tissue homeostasis. They reside in tissues to engulf and destroy microbes and alert other immune cells by secreting lipid mediators, cytokines, and chemokines, while also presenting foreign antigens on their surface. To carry out their functions, baseline macrophages (M0) can be polarized into pro-inflammatory M1 macrophages or anti-inflammatory M2 macrophages, depending on the stimuli in their immediate environment. M1 macrophages recognize pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs) via their pattern recognition receptors (PRRs), resulting in secretion of pro-inflammatory cytokines, chemokines, and lipid mediators. These substances contribute to tissue inflammation. M2 macrophages resolve inflammation and promote tissue repair. Although inflammation is important for initial host defense if it is sustained over a long period of time it can lead to diseases such as atherosclerosis, diabetes, and cancer. Carboxylesterases (CES) belong to the α/β-hydrolase fold family of proteins and catalyze the hydrolysis of amide- or ester-containing substrates. Six isoforms are found in humans, and CES1 and 2 have been the most extensively studied. CES1 is known to regulate triacylglycerol (TAG) levels and other lipid mediators in macrophages. In this study, both normal (control) and CES1 knockdown (CES1KD) THP-1 macrophages were used to examine gene expression signatures under baseline conditions or following classical or alternative activation by lipopolysaccharide or IL-4, respectively. RNA was extracted and subjected to RNA-seq. Interestingly, Gene Ontology (GO) analysis of CES1KD macrophages under baseline conditions demonstrated several identified biological processes, cellular components, and molecular functions that were upregulated to the same extent as those in classically activated control macrophages (M1 macrophages). Kyoto Encyclopedia of Genes and Genomes (KEGG) and Reactome data from basal CES1KD cells also showed an upregulation of pathways that were similar to those identified in the control M1 macrophages. However, this similarity was not reflected in the down regulated pathways. Our results suggest that CES1 plays a regulatory role in macrophage inflammation, and its deficiency (knockdown) in macrophages under resting conditions reveals a similar gene expression signature as that seen in control macrophages that express CES1. [Supported by NIH R15HL157818-01A1

Presenter: Fenny Patel

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Hasan C Tekedar

Title: Comparative analysis of Genomic diversity of A. hydrophila and its virulence factors

Abstract: Aeromonas hydrophila, a highly adaptable Gram-negative bacterium, presents a multifaceted challenge in both aquatic ecosystems and clinical contexts. Its genomic versatility confers to its pathogenicity, allowing to infect a diverse range of hosts, from aquatic species to humans, making it a prominent pathogen of concern. We conducted a comprehensive comparative genomics study with a dataset comprising of 5 newly sequenced strains in addition to 185 genomes sourced from the National Center for Biotechnology Information (NCBI) database. The study aimed to investigated distribution of virulence genes, global dissemination of pathotypes and potential mechanisms of virulence. Our approach included constructing a phylogenetic tree to elucidate the evolutionary relationships among strains and pan/core genome analysis was performed to gain insights into the genomic diversity and conserved elements within A. hydrophila, assisting in identifying strain-specific traits and potential virulence factors. Next, we analyzed virulence factors such as secretion systems, flagellum, and pilus core elements to identify diversity in the genomes. Prophage dynamics were also analyzed to identify its influence in virulence and genetic exchange, thereby impacting the adaptability and pathogenic potential of A. hydrophila. Lastly, we investigated CRISPR arrays in A. hydrophila genomes, assessing CRISPR-Cas types, spacer lengths, and organization. This revealed intricate interactions with phages that have played a role in shaping these genomes, potentially conferring advantages in terms of virulence. Overall, our analyses were motivated not only by a desire to unveil the genomic intricacies of A. hydrophila but also by the pressing need to address the critical challenges it poses, particularly in the context of aquaculture where its adaptability and pathogenic potential can have far-reaching consequences.

Presenter: Fenny Patel

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Hasan C. Tekedar - Assistant Research Professor - Comparative Biomedical Sciences

Title: Mutation of TAD operon in Aeromonas hydrophila ML09-119 for determining its role in bacterial virulence.

Abstract: Aeromonas hydrophila, a versatile gram-negative facultative anaerobe thriving in both freshwater and brackish environments, poses a threat to a wide range of hosts, including amphibians, fish, mammals, birds, reptiles, and humans, leading to septicemia, necrotizing fasciitis, and gastroenteritis. Since 2009, a virulent A. hydrophila (vAh) strain has caused significant mortalities for US catfish farmers. Despite progress in understanding its infection mechanisms, controlling vAh remains a challenge. Our comparative genomics analysis for 169 A. hydrophila genomes revealed a consistent presence of the Tad (tight adherence) operon, essential for the assembly of Flp (fibrial low-molecular-weight protein) pili, in most epidemic A. hydrophila vAh isolates. The Tad system confers adaptive advantages by facilitating host-pathogen interactions via cell adherence, biofilm formation, natural competence, and twitching motility. We further investigated whether the exclusive presence of the Tad operon serves as a hallmark of epidemic A. hydrophila strains. To elucidate the role of the Tad operon in A. hydrophila pathogenicity, we generated a Tad knockout mutant through in-frame deletion in the epidemic A. hydrophila strain ML09-119. This targeted mutagenesis led to the disruption of the entire Tad operon, consisting of 13 genes and deletion of 10,827 base pairs from A. hydrophila strain ML09-119. Additionally, we characterized the vAhΔtad via various assays, including resistance to extreme pH, exposure to hydrogen peroxide, tolerance to temperature stress and alkaline conditions, and growth kinetics. Furthermore, we conducted an immersion challenge experiment in catfish fingerlings, which revealed a significantly reduced mortality rate ($p < 0.05$) among fingerlings infected with the vAhΔtad mutant compared to the parent vAh strain ML09-119 (mortality rates of 74.36% and 14.65%, respectively). These findings will enhance our understanding of the role of the Tad cluster in A. hydrophila pathogenicity with broader implications for unraveling bacterial pathogenic mechanisms driven by type 4 pili to combat bacterial infections.

Presenter: Clark Hensley

Level of Study: Master's

Category: Engineering

Advisor: Dr. Matthew Priddy, Associate Professor of Mechanical Engineering

Title: ODBPlotter: Open Source Improvements in Data Processing and Visualization for Wire Arc Additive Manufacturing

Abstract: Wire-arc directed energy deposition (WA-DED) is a metal-based layer-wise additive manufacturing (AM) process. Finite element analysis (FEA) is a process for computationally modeling the thermal and mechanical evolution of a WA-DED part during and after the deposition process. These models provide insight to the final mechanical state of deposited parts, including potential inaccuracies or weak points. Abaqus is a commercial FEA software used across research and industry to perform this modeling. Though Abaqus is a state-of-the-art finite element solver, its data post-processing capabilities are underdeveloped for modern research. Abaqus provides a number of proprietary libraries to interface with the Python programming language to enable data post-processing and analysis. This Python interface, however, uses the deprecated and unsafe Python 2 version of the language. ODBPlotter is a modern Python version 3 interface for the Abaqus environment, aiming to improve the user experience of interfacing with Abaqus. ODBPlotter is more time- and space-efficient than Abaqus, provides greater security with Python 3, and brings Abaqus datasets into the robust, open-source formats, especially the .hdf5 data storage format, of the modern data science ecosystem. The primary benefits of ODBPlotter are its efficiency, portability, and robustness as compared to previous Abaqus data processing technologies.

Presenter: Zeenat Islam

Level of Study: PhD

Category: Engineering

Advisor: Dr. Hussein Gharakhani, Department of Agricultural and Biological Engineering

Title: Predicting moisture content and bulk density of various grains from their dielectric properties

Abstract: Moisture content of grains is a critical variable in the buy-sell process to monitor quality production and crop analysis. Dielectric properties are intrinsic electric properties that characterize the electric field and material interaction. For water-containing materials and because of the polar nature of water, at microwave frequencies there is a strong coupling between the electric field of an electromagnetic wave and the material. This constitutes the basis for developing nondestructive methods and sensors for real-time moisture content determination from measurement of the dielectric properties at microwave frequencies.

However, because the dielectric properties are dependent on other variables including frequency, temperature, composition, and bulk density for granular and particulate materials, there is a need to take into account/eliminate their respective effects in moisture calibration equation. In the last two decades, USDA-ARS has collected an extensive database of dielectric properties for cereal grains, oilseeds, and in-shell nuts for varying conditions of frequency, temperature, bulk density, and moisture content. The main objective of our investigation is to use machine learning and AI-based algorithms to predict moisture content from the dielectric properties measured at a given frequency.

We have implemented a deep neural-network (DNN) with variable parameters for each grain type to predict moisture content and bulk density of six different grains, provided its dielectric properties for different microwave frequencies. Three different variants of the DNN were used to vary its hidden layers, number of units, learning iterations, batch size and prediction targets to find a model for each grain. Evaluation metrics used for each model variant were root-mean-squared error (RMSE), coefficient of determination and inference time.

Presenter: Sama Ebrahimi Bajgani

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Mehdi Ghahremani

Title: 4C Developmental Model of Courage: A Framework for Understanding and Measurement

Abstract: The stories of courageous individuals worldwide inspire countless others to conquer their fears and embark on courageous journeys. While courage has been studied for centuries, there's a crucial gap in the field—a developmental model to explain the progression of courageous behavior. We propose the 4C Model of Courage, paralleling the 4C Model of Creativity. Our framework defines four levels of courage: everyday acts of courage in ordinary life situations. It involves small acts of bravery that may not require significant risks or challenges but still require individuals to step out of their comfort zone. Little-C courage involves demonstrating courage in more challenging situations or domains. It encompasses acts of bravery that require individuals to overcome obstacles, face risks, and make difficult decisions. Pro-C courage refers to professional or domain-specific courage. It involves demonstrating courage within a particular field or domain requiring expertise and specialized knowledge. Big-C courage represents extraordinary acts of courage that significantly impact a broader scale. It involves acts of bravery recognized as exceptional and profoundly influencing society, culture, or humanity. These remarkable feats resonate across time and space.

While the 4C Model of Creativity has received extensive attention and scrutiny, its application to courage offers a novel lens to comprehend and categorize various expressions of courageous behavior. Our framework for courage provides valuable insights into how courage is perceived and valued across diverse cultures and societies. It facilitates cross-cultural research on courage, shedding light on cultural disparities in courageous behavior. By understanding courage within varying social contexts, we aim to foster dialogue, empathy, and an appreciation for the manifold manifestations of courage.

This study holds the potential to corroborate the practicality of implementing the Developmental Courage Model within educational settings, exploring the cultivation of courage through pedagogical methods. Through a comprehensive review of existing literature, our primary objective is to deepen our comprehension of courage as a psychological concept. Additionally, we aspire to enhance this understanding by devising a robust measurement tool tailored to the 4C Model of Courage, thereby contributing to the ongoing discourse on this transformative trait.

Presenter: Claire Bland

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Kasia Gallo (Counseling, Higher Education Leadership, Educational Psychology, and Foundations)

Title: Motivational Factors in Online Learning

Abstract: Current research suggests that students in online education are experiencing challenges in their motivation. This paper reviews 20 empirical studies to identify what specific factors are necessary for academic motivation and what is impairing student motivation in online education. Participants in these studies were secondary and postsecondary students from a variety of backgrounds. Participants' motivation was evaluated using self-report questionnaires and surveys that mostly measured students' perceptions of online education. Survey items also included questions regarding students' perceptions of their own motivation. The Motivated Strategies for Learning Questionnaire (MSLQ) was a scale that was used frequently in studies to measure motivational factors. Motivation was also evaluated by measuring achievement through students' GPAs. Additionally, some studies had students evaluate interventions designed to enhance motivation. Results suggest that communication, self-efficacy, and self-regulation are the three main factors most valued by students and most necessary for motivation in online education. This paper highlights the challenges that online education may pose to these factors and how these can be remedied.

Presenter: Ayuumah Sandys Seth

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Sareh Karami

Title: Positive Creativity in Higher Education: Investigating Rural Mississippi

Abstract: The concept of creativity continues to be studied, with positive creativity being the most recent development in the field. Thus, little research exists on positive creativity. Researchers have defined positive creativity as an idea that is both novel and useful while also being positive or constructive for the future generation (Sternberg & Karami, 2022). The current study consisted of a semi-structured interview with seven educators at a Southern United States University on their perception and implementation of creativity in their classroom. Results indicate that most professors have a loose understanding of positive creativity as defined in the field. Themes of novelty, usefulness, interests in personal reward and growth, and other's needs for balance and empathy for others emerged in their strategies and techniques for fostering creativity.

Presenter: Seger McGuire

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Sareh Karami; Assistant Professor; The Department of Counseling, Higher Education Leadership, Educational Psychology, and Foundations

Title: Positive Creativity in Higher Education: Investigating Rural Mississippi

Abstract: The concept of creativity continues to be studied, with positive creativity being the most recent development in the field. Thus, little research exists on positive creativity. Researchers have defined positive creativity as an idea that is both novel and useful while also being positive or constructive for the future generation (Sternberg & Karami, 2022). The current study consisted of a semi-structured interview with seven educators at a Southern United States University on their perception and implementation of creativity in their classroom. Results indicate that most professors have a loose understanding of positive creativity as defined in the field. Themes of novelty, usefulness, interests in personal reward and growth, and other's needs for balance and empathy for others emerged in their strategies and techniques for fostering creativity. We aim to conduct further interviews to collect additional data.

Presenter: Grace Austin

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Sareh Karami, (Assistant Professor, Dept. of Educational Psychology)

Title: Positive Creativity in Higher Education: Investigating Rural Mississippi

Abstract: The concept of creativity continues to be studied, with positive creativity being the most recent development in the field. Thus, little research exists on positive creativity. Researchers have defined positive creativity as an idea that is both novel and useful while also being positive or constructive for the future generation (Sternberg & Karami, 2022). The current study consisted of a semi-structured interview with seven educators at a Southern United States University on their perception and implementation of creativity in their classroom. Results indicate that most professors have a loose understanding of positive creativity as defined in the field. Themes of novelty, usefulness, interests in personal reward and growth, and other's needs for balance and empathy for others emerged in their strategies and techniques for fostering creativity. We aim to conduct further interviews to collect additional data.

Presenter: Samuel Stewart

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Mehdi Ghahremani (Assistant Professor - Counseling, Higher Educational Leadership, Educational Psychology, and Foundations)

Title: Relationship Between Scientific-reasoning Skills and Thinking Styles in University Students

Abstract: There is a need to enhance students' scientific-thinking abilities to prepare them for successful careers in science-related fields. Effective scientific thinking requires a balance between critical evaluation, logical reasoning, creativity, and attention to detail, which can be influenced by individual thinking preferences. Applying Sternberg's (1988) Theory of Mental Self-government, we examined the relationship between undergraduate students' scientific-reasoning skills and their thinking preferences (N = 203). Participants comprised of 203 undergraduate students from a Southern university, with diverse demographics. The survey data contained five main components, including measures of scientific reasoning, psychometric tests, a thinking-styles inventory, and a demographic questionnaire. The Thinking Styles Inventory—Revised II (TSI-R2) assessed participants' thinking styles, while scientific reasoning skills were developed by Sternberg and Sternberg (2017; Sternberg et al., 2019). Psychometric tests included a Letter Set and Number Series to measure the fluid aspect of general intelligence. Correlational analyses suggest that there are statistically significant correlations between scientific-reasoning scores and three styles of thinking (Executive, Hierarchical, and Conservative). While these results are statistically significant, they only suggest weak relationships. Notably, the measures of fluid intelligence (Letter Sets and Number Series) exhibit stronger correlations with scientific-reasoning skills, thus implying the importance of assessing and fostering scientific reasoning and thinking among university students. Implications are multifold, HEIs can tailor their instructional methods to students' cognitive preferences, incorporate project-based learning, implement research mentorship programs. There are also very broad application ideas; most notable would be bridging the gap between the theoretical and empirical studies on thinking styles can lead to a more effective teaching method for university students.

Keywords: Thinking styles, conservative thinking, scientific thinking, scientific reasoning

Presenter: Shundrell McMullan

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Kayla Bates-Brantley, Assistant Professor, School Psychology Department of CHEF

Title: Riding with My Sis 'n Nem: Increasing Protective Factors for Black Girls

Abstract: As the student population in public schools in the U.S. are becoming more diverse, there has been an increased need to meet the demand of providing care to these students. While school should be a place where students feel safe and welcomed, Black students frequently experience racial discrimination by their peers and teachers leaving a detrimental impact on their perspective identities and self-concept (Fisher et al., 2000). Specifically, Black girls experience high rates of criminalization in schools- receiving more punitive punishments and referrals to law enforcement than white females (Morris, 2018). Previous studies have shown that an increased racial identity and self-concept can serve as protective factors for Black students (Wakefield & Hudley, 2007). Sisters of Nia is a 14-week intervention that provides a creative package of protective factors for Black adolescent girls. Initially, Belgrave et al. (2000) demonstrated an increase in racial identity using Sisters of Nia compared to a control group. More recently, Sisters of Nia has also resulted in a decrease in verbal and relational aggression (Aston et al., 2018). In the present study, the Sisters of Nia intervention was implemented to measure racial identity, self-concept, and positive peer and teacher interactions with eighth and ninth-grade Black girls in a school setting in the southeastern region of the U.S.

To evaluate the effectiveness of the Sisters of Nia intervention on positive social interaction, a changing criterion design was used within an interdependent group contingency. A paired samples t-test was used to calculate significant differences between pretest and posttest scores on the Multidimensional Inventory of Black Identity-teen (MIBI-T) and the Tennessee Self Concept Scale, Second Edition (TSCS-2) to evaluate the effectiveness of the intervention on racial identity and self-concept, respectively. Additionally, office discipline referrals (ODRs) were totaled for the previous school year and then again during the intervention. ODRs in the previous school year included various aggressive behaviors (e.g., physical, relational, and verbal); however, physical aggression was not reported during the intervention. The results illustrate the impact of protective factors embedded within a culturally relevant intervention on adolescent Black girls within the educational setting.

Presenter: Georgia Wood

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Mehdi Ghahremani, Professor of Educational Psychology

Title: 4C Developmental Model of Courage: A Framework for Understanding and Measurement

Abstract: The stories of courageous individuals worldwide inspire countless others to conquer their fears and embark on courageous journeys. While courage has been studied for centuries, there's a crucial gap in the field—a developmental model to explain the progression of courageous behavior. We propose the 4C Model of Courage, paralleling the 4C Model of Creativity. Our framework defines four levels of courage: everyday acts of courage in ordinary life situations. It involves small acts of bravery that may not require significant risks or challenges but still require individuals to step out of their comfort zone. Little-C courage involves demonstrating courage in more challenging situations or domains. It encompasses acts of bravery that require individuals to overcome obstacles, face risks, and make difficult decisions. Pro-C courage refers to professional or domain-specific courage. It involves demonstrating courage within a particular field or domain requiring expertise and specialized knowledge. Big-C courage represents extraordinary acts of courage that significantly impact a broader scale. It involves acts of bravery recognized as exceptional and profoundly influencing society, culture, or humanity. These remarkable feats resonate across time and space. While the 4C Model of Creativity has received extensive attention and scrutiny, its application to courage offers a novel lens to comprehend and categorize various expressions of courageous behavior. Our framework for courage provides valuable insights into how courage is perceived and valued across diverse cultures and societies. It facilitates cross-cultural research on courage, shedding light on cultural disparities in courageous behavior. By understanding courage within varying social contexts, we aim to foster dialogue, empathy, and an appreciation for the manifold manifestations of courage. This study holds the potential to corroborate the practicality of implementing the Developmental Courage Model within educational settings, exploring the cultivation of courage through pedagogical methods. Through a comprehensive review of existing literature, our primary objective is to deepen our comprehension of courage as a psychological concept. Additionally, we aspire to enhance this understanding by devising a robust measurement tool tailored to the 4C Model of Courage, thereby contributing to the ongoing discourse on this transformative trait.

Presenter: Amber Crenshaw and Dr. Elaine Wei

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Elaine Wei; Associate Professor & Program Coordinator of Educational Psychology.

Title: Examining Trajectories of Academic Achievement in Native and Non-Native English Speakers: Preliminary Findings Based on National Samples

Abstract: The present study analyzed the trajectories of achievement scores in reading, math, and science between native speakers of English and non-native speakers of English. A national database, the Early Childhood Longitudinal Study (ECLS) which was conducted by the National Center for Educational Statistics (NCES) was used in this study, and sample sizes varied from 5,000 to 18,000 for each analysis. The ECLS data set contains numerous variables, for this study the longitudinal scores from kindergarten through fifth grade in the subject domains were used. The longitudinal data allowed us to analyze the trajectory of participants scores in these areas and compare the two groups (native English speakers vs. non-native English speakers).

A series of 3 (between-subjects factor = language status: native English speakers vs. non-native speakers) by 4 (within-subjects factor = time/school grades: K, 1st, 2nd, 3rd, 4th, and 5th) mixed-design ANOVAs were conducted to examine the trajectories of achievement over time. Overall, the ANOVAs revealed significant main effects of language status and main effects of school grade/time, but non-significant interactions between language status and time.

Specifically, non-native speakers showed lower achievement in reading, math, and science at the beginning of their academic career, and their achievement trajectories never appeared to catch up to those of native speakers over time. In other words, the achievement gap between native and non-native English speakers remained constant and did not show a tendency to narrow within this data set. These findings suggest that language status is a significant factor in academic achievement trajectories and should be considered in educational policy and practice.

In conclusion, the present study provides insight into the trajectories of achievement between native and non-native speakers of English in reading, math, and science. The findings suggest that language status is a significant factor in academic achievement trajectories and should be considered in educational policy and practice. Future research could explore the factors that contribute to non-native speakers' lag in all these important academic domains.

Presenter: Sabyasachi Biswas

Level of Study: PhD

Category: Engineering

Advisor: Ali C. Gurbuz (Assistant Professor-ECE)

Title: CV-SincNet: Learning Complex Sinc Filters from Raw Radar Data for Computationally Efficient Human Motion Recognition

Abstract: Radiofrequency (RF) sensing has been increasingly used in many applications such as fall-motion recognition, human-machine interfacing, gesture-controlled home appliances, and American sign language (ASL) recognition. However, most current activity classification techniques employ a two-stage process. First, the micro-Doppler spectrograms or a temporal sequence of range-Doppler (RD) maps are created. Then, in the second stage, the created representation is used with deep learning (DL) or machine learning (ML) techniques. In this paper, we propose a more interpretable complex-valued neural network architecture to directly classify human activities from the complex-valued raw radar data. The one-dimensional (1D) slowtime radar data is used as the raw radar input, and the complex sinc function is used as the first layer of the proposed model. The sinc filter is a windowed band-pass filter in which the model learns only the lower and higher frequencies of the bandpass filter. To verify our model, an American Sign Language (ASL) dataset consisting of 15 activity classes is selected. The proposed complex-valued SincNet (CV-SincNet) provides higher classification accuracy compared to the direct application of a convolutional neural network (CNN) or real-valued SincNet. Enhanced results are observed compared to standard CNN models applied on the Micro-Doppler spectrogram images.

Presenter: M M Nabi

Level of Study: PhD

Category: Engineering

Advisor: Dr. Ali C. Gurbuz, Assistant Professor, Electrical and Computer Engineering

Title: Deep-learning based Global Soil Moisture estimation using CYGNSS Delay Doppler Maps

Abstract: A high spatial and temporal resolution global soil moisture product is essential for understanding hydrologic and meteorological processes and enhancing agricultural applications. Global Navigation Satellite System (GNSS) signals at L-band frequencies that reflect off the land surface can convey high-resolution land surface information, including surface soil moisture (SM). Cyclone Global Navigation Satellite System (CYGNSS) constellation generates Delay-Doppler Maps (DDMs) that contain important Earth surface information from GNSS reflection measurements. DDMs are affected by soil moisture and other factors such as complex topography, soil texture, and overlying vegetation. Including entire DDM information can help reduce the uncertainty of SM estimation under different conditions along with remotely sensed geophysical data. In this work, we propose a deep learning (DL) framework to a global scale by utilizing processed DDM measurements (analog power, effective scattering area, and bistatic radar cross-section) and ancillary data (elevation, slope, water percentage, soil properties and vegetation water content). The DL model is trained and evaluated using the Soil Moisture Active Passive (SMAP) mission's enhanced SM products at 9-km resolution. This study comprehensively evaluates the DL model against publicly available CYGNSS-based SM products at a quasi-global scale. In addition to the typical comparison against in-situ measurements, a robust triple collocation technique is used to evaluate the DL-based SM product and other CYGNSS-derived SM products.

Presenter: Fahmida Islam

Level of Study: PhD

Category: Engineering

Advisor: Dr. John E Ball, Associate Professor, Electrical and Computer Engineering

Title: Design and Optimization of a Deep Reinforcement Learning (DRL) based Longitudinal Velocity Control Model

Abstract: Longitudinal velocity control or adaptive cruise control (ACC) is one of the common advanced driving features, that aims to assist the driver from fatigue. A lot of models for ACC are available, such as Proportional, Integral, and Derivative (PID), Model Predictive Control (MPC), and reinforcement learning (RL). Recently a deep RL technique called deep deterministic policy gradient (DDPG) has been widely used for velocity control. DDPG is a mixture of deep learning (DL) and RL method, that uses neural networks (NN) to estimate its action. In this work, we integrate an attention DDPG model with the attention mechanism. The network structure consists of one hidden layer with 128 neurons, which has been deployed in our previous work. The reward function has been designed to concentrate on overall safety and comfort. Therefore, we included a few criteria like time-to-collision, safe distance, jerk, and acceleration limit, for which the agent will be rewarded or penalized. The attention mechanism in DDPG increases the overall effectiveness of the model by reducing focus on the less important features. We trained our model with a publicly available dataset. For testing, we created simulated sensor data in the Mississippi State University Autonomous Vehicular Simulator (MAVS) and collected data using the vehicle from the EcoCAR Mobility Challenge. We introduced some unknown scenarios within the simulation environment to assess the ACC model's performance. We compared our model with the baseline DDPG model. The primary objective of this study is to evaluate the performance of the Attention DDPG-based ACC model under varying driving conditions. The testing result shows the agent can maintain safety and comfort across a range of driving conditions.

Presenter: Fahmida Islam

Level of Study: PhD

Category: Engineering

Advisor: Dr. John E. Ball, Associate Professor, Electrical and Computer Engineering

Title: Enhancing Velocity Control: Integrating Attention Mechanism and Deep Deterministic Policy Gradient (DDPG) for Optimizing Safety and Comfort

Abstract: The transportation system is moving towards higher levels of autonomy. Speed control, longitudinal control, or adaptive cruise control (ACC) are intended to provide driver assistance by controlling vehicle speed and maintaining a safe distance from the preceding vehicle. Artificial intelligence (AI) and machine learning (ML) pave the way for robust navigation and decision-making in complex environments. In this paper, we propose a comprehensive framework for speed control using a deep reinforcement learning algorithm to enhance safety and comfort. For this, we incorporate the deep deterministic policy gradient (DDPG) framework, a deep reinforcement learning (DRL) algorithm, with the attention mechanism. Many works achieved smooth vehicle control output from the base DDPG algorithm of different network structures, but we barely found any framework with attention mechanism-based DDPG for longitudinal vehicle control. The baseline DDPG framework is based on fully connected layers. However, when we introduce the attention mechanism to the DDPG model, it helps to decrease focus on less important features and enhances the overall model effectiveness. We have performed an ablation study to determine the impact of the number of layers and neurons in the hidden layer. We designed a custom reward function as our priority is to improve overall safety and comfort. We evaluated our model on three diverse datasets, including publicly available data, simulated data, and sensory data collected with experiments. We demonstrate that our architecture exceeds the state-of-the-art in terms of safety, maintaining a safe distance, avoiding any negative impact, and increasing comfort.

Presenter: Ahmed Manavi Alam

Level of Study: PhD

Category: Engineering

Advisor: Ali Gurbuz, Assistant Professor, Electrical and Computer Engineering

Title: Microwave Radiometer Calibration Using Deep Learning with Reduced Reference Information and Two-Dimensional Spectral Features

Abstract: The precision of geophysical data retrievals, including parameters such as atmospheric temperature, humidity, soil moisture, sea surface temperature, snow cover extent, vegetation health, and atmospheric composition, obtained via radiometric measurements, is intrinsically linked to the quality of calibration procedures. This encompasses the attainment of both absolute radiometric accuracy and spectral consistency. Radiometers have employed various calibration techniques, which include the utilization of external calibration targets, vicarious sources, and internal calibrators like noise diodes or matched reference loads. Calibration techniques pose several significant challenges such as frequency dependence, instrumental effects, environmental influences, drift, aging, and radio frequency interference. Recent advancements in hardware and processing units have enabled passive radiometers to collect raw samples of the observed scene that contain both temporal and spectral information. Leveraging advanced modeling techniques such as deep learning (DL) architecture can detect subtle correlations, non-linear dependencies, and higher-order interactions within the data. This capability allows them to extract valuable information that may have been difficult to capture using conventional methods. This study will utilize NASA's Soil Moisture Active Passive (SMAP) satellite's level 1A and level 1B data products to develop a DL-based radiometer calibrator to estimate antenna temperature. Spectrograms of second raw moments equivalent to power carrying the two-dimensional spectral features will be the primary input in a supervised convolutional neural network-based architecture. DL-based calibrator has demonstrated high correlation and low root mean square error when incorporating spectral information from both reference and noise diodes and when not considering this information. The findings from this analysis will suggest that the ancillary features in DL-based calibrators such as internal thermistor temperature and loss elements exhibit sufficient accuracy in estimating antenna temperature to compensate for variations in receiver noise temperature and short-term gain fluctuations in the absence of the reference load and noise diode power. The proposed calibration technique with reduced reference information might enable radiometers for a higher number of antenna scene observations within a footprint.

Presenter: Eli Riser

Level of Study: Master's

Category: Engineering

Advisor: Dr. Chaomin Luo, Electrical & Computer Engineering Associate Professor

Title: Multi-robot Navigation using improved RRT*-Smart with Digital Twin Technology

Abstract: Digital twin technology can play a significant role in multiple robots' navigation by providing a virtual representation of the physical environment, robots, and their interactions. Digital twins can create a highly detailed, real-time representation of the physical environment where robots operate. This includes capturing the layout of obstacles, landmarks, and dynamic elements such as humans or other moving objects. Such a detailed representation can allow efficient and accurate navigation in difficult scenarios while enabling cost-effective robot solutions.

In this research an RRT*-Smart based path planning algorithm will be tested and extended by use of deep reinforcement learning. This improved RRT*-Smart autonomous robot navigation and mapping algorithm will then be altered for use with multiple robots. At the same time, simulations driven by digital twin technology will fine-tune this navigation in real-time using gradient-based trajectory optimization. This proposed framework attempts to introduce a more efficient solution for navigating a partially known, static environment, while making use of the strengths of a centralized multi-robot system. This framework will be tested first in simulation and then with physical robots to determine its efficacy.

Presenter: James Huston Rogers III

Level of Study: Master's

Category: Engineering

Advisor: Dr. Chaomin Luo - Electrical and Computer Engineering

Title: Sensor-Based Multi-Waypoint Autonomous Robot Navigation with Graph-Based Models

Abstract: Multi-waypoint navigation for autonomous robot is in high demand in real-world robotics applications including search and rescue, disaster response, and environment exploration. In this paper, a sensor-based methodology is proposed for validation of autonomous robot multi-waypoint navigation utilizing graph-based models with adjacent node selection. In addition to time and distance efficiency, the proposed graph-based models incorporate environmental safety and awareness as a driving feature. These models provide path planning for autonomous robot experiments. This methodology is implemented in both a real-world and simulated environment with static and dynamic obstacles utilizing a Clearpath Jackal unmanned ground vehicle (UGV) featuring four-wheel drive, GPS, odometry, and a Velodyne VLP-16 LiDAR as the experimental robot configuration. The LiDAR is the primary navigation sensor, and is also utilized to map the environment prior to autonomous experiments. The proposed model is evaluated in terms of efficiency in simulated and real-world environments including dynamic obstacle avoidance.

Presenter: Cemre Omer Ayna

Level of Study: PhD

Category: Engineering

Advisor: Ali Cafer Gurbuz

Title: Task-Specific Hyperspectral Band Selection with Machine Learning

Abstract: Hyperspectral sensors acquire spectral responses from objects with a large number of narrow spectral bands. The large volume of data may be costly in terms of storage and computational requirements. In addition, hyperspectral data are often information-wise redundant. Band selection intends to overcome these limitations by selecting a small subset of spectral bands that provide more information or better performance for particular tasks. However, existing band selection techniques do not directly maximize the task-specific performance, but rather utilize hand-crafted metrics as a proxy to the final goal of performance improvement. In this study, we propose a deep learning (DL) architecture composed of a constrained measurement learning network for band selection, followed by a classification network. The proposed joint DL architecture is trained in a data-driven manner to optimize the classification loss along band selection. In this way, the proposed network directly learns to select bands that enhance the classification performance. Our evaluation results with Indian Pines (IP) and the University of Pavia (UP) datasets show that the proposed constrained measurement learning-based band selection approach provides higher classification accuracy compared to the state-of-the-art supervised band selection methods for the same number of bands selected. The proposed method shows 89.08% and 97.78% overall accuracy scores for IP and UP respectively, being 1.34% and 2.19% higher than the second-best method.

Presenter: Yehong Peng

Level of Study: PhD

Category: Engineering

Advisor: Dr. Yong Fu, Electrical and Computer Engineering

Title: Towards Grid Resilience: Efficient Reserve Constrained AC Optimal Power Flow

Abstract: In modern power systems, integrating reserve requirements into operational optimization is essential for ensuring grid reliability. The Alternating Current Optimal Power Flow (ACOPF) problem, characterized by its large-scale and non-convex nature, inherently presents considerable computational challenges. With the introduction of reserve-related variables and constraints, these challenges further escalate due to an increase in the problem's dimensionality. To address this, this paper introduces a comprehensive methodology to efficiently handle the Reserve Constrained ACOPF (RC-ACOPF) problem. Our approach simplifies the problem by strategic elimination of redundant constraints and ensures the achievement of an optimal solution by a specialized optimization algorithm based on the Primal-Dual Interior Point method. The performance of our methodology is illustrated through various case studies, ranging from a 3-bus system to a large-scale 23643-bus system.

Presenter: Bidya Debnath

Level of Study: PhD

Category: Engineering

Advisor: Dr. Junming Diao

Title: UAV Swarm based isotropic Planar Aperiodic Phased array of Dipole Antenna.

Abstract: Ideal isotropic antenna that can provide equal gain radiation in every direction does not exist in reality. Every type of antenna exhibits directivity to some extent. In case of close to isotropic antennas, gain can be very low. To achieve higher gain, size of antenna needs to be increased. The problem of increasing antenna size can be tackled with phased array antenna, but it presents a new problem of higher side lobe. The goal of this project is to introduce a phased array antenna arrangement that exhibits near isotropic radiation pattern as well as high directivity at steered angle. Dipole antennas rotated at various angles along X-axis and mounted on UAVs that are placed aperiodically on YZ plane are used to construct the aperiodic phased array antenna. The positions and rotation angle of the dipole antenna elements are determined using genetic algorithm. This arrangement is compared with that of conventional hexagonal array antenna placed on YZ plane based on uniformity of directivity and peak side lobe level at different steered elevation.

Presenter: Timothy Sellers

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Chaomin Luo

Title: A Heterogeneous Multi-Robot System for Early Radiation Detection in Power Plants

Abstract: The increasing global population has heightened the demand for diverse energy sources, prominently including nuclear energy. Although nuclear power stands out for its efficiency and reliability in electricity generation, it poses formidable challenges related to radiation and nuclear waste management. Radiation leaks within nuclear power plants can have severe consequences, necessitating precise early detection systems. This research introduces a specialized heterogeneous multi-robot early detection system tailored for nuclear power plants, with the overarching goal of enhancing safety and operational efficiency. The heart of this system lies in the strategic deployment of autonomous vehicles, comprising Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs). These vehicles collaborate seamlessly to create a robust and adaptable early detection system. A pivotal component of our proposed system is a deep learning-based routing scheme meticulously designed for UAVs. This scheme harnesses advanced techniques like goal embedding and coordinate position features to compute optimal flight paths for UAVs. This empowers them to systematically survey the entire power plant, expeditiously identifying any potential radiation leaks. By utilizing deep learning the UAVs can maximizing their coverage and detection capabilities. Furthermore, we present a deep learning-based complete coverage path planning (DL-CCPP) navigation scheme tailored for our UGVs. These ground vehicles play an indispensable role in navigating the intricate terrains within the power plant, locating workers who may need assistance, and pinpointing the exact sources of radiation leaks. The DL-CCPP draws upon data collected by the UAVs, utilizing the images they capture to systematically construct comprehensive coverage paths for the UGVs. This strategic approach ensures a highly efficient and effective radiation detection process throughout the entire facility. By synergizing the capabilities of UAVs and UGVs with advanced deep learning-based routing and navigation schemes, our system aims to markedly enhance safety protocols, minimize human exposure to radiation, and enable swift responses to potential radiation hazards. Rigorous simulation and comparison studies provide robust evidence of the model's efficiency and effectiveness, making a substantial contribution to the ongoing growth and sustainable operation of nuclear power plants. In doing so, it safeguards both plant personnel and the surrounding environment, addressing a paramount concern in the realm of nuclear energy.

Presenter: Walaa Alqwider

Level of Study: PhD

Category: Engineering

Advisor: Vuk Marojevic

Title: Enabling Coexistence Between Aerial and Ground Base Stations: A Traffic-Driven Scheduler, Power Control, and 2D Placement Design Using Deep Reinforcement Learning

Abstract: The recent integration of Unmanned Aerial Vehicles (UAVs) into cellular networks presents a promising solution for ensuring uninterrupted connectivity, especially in densely populated areas and during events where traditional ground-based infrastructure may be insufficient. Equipped with cellular technology, UAVs can swiftly deploy in high-demand areas as aerial base stations, complementing ground-based stations to enhance network capacity, coverage, and performance. Nevertheless, deploying UAV-assisted cellular networks in densely populated environments poses challenges, primarily concerning interference management, especially when signals from aerial and ground-based stations overlap. This necessitates the development of an efficient and adaptable radio resource management (RRM) strategy, encompassing aspects like transmission power control for UAVs and ground stations, interference mitigation, UAV mobility management, frequency resource allocation, user association, and scheduling. In this study, we propose an innovative approach that utilizes deep reinforcement learning for traffic-based scheduling, power control, and placement design in UAV-assisted cellular networks. Our method aims to facilitate the coexistence of UAVs and ground base stations, effectively addressing the complex quality-of-service requirements in densely populated wireless environments.

Presenter: Timothy Sellers

Level of Study: PhD

Category: Engineering

Advisor: Dr. Chaomin Luo

Title: Enhancing Emission Monitoring in Power Plants with a Multi-Robot Graph-Based System

Abstract: In recent years, autonomous vehicle (AV) technology has emerged as a valuable solution for addressing various challenges within power stations, including the collection of emission data, security surveillance, and radiation detection. This research presents a novel approach to enhance the efficiency and effectiveness of AV-based solutions in these critical tasks within complex and inaccessible power station environments. The method utilizes dynamically updating Delaunay Triangulation (DT) with obstacle fusion. The primary objective of this study is to overcome two common issues encountered in graph-based AV navigation within densely populated workspaces: AVs positioned outside the graph and the connection between sub-graphs. These challenges can disrupt the seamless mapping of the environment and lead to gaps in emission data collection and suboptimal navigation paths within power stations.

To address these challenges, the proposed methodology introduces an obstacle fusion technique that groups small and nearby obstacles within a specified range. This reduces time complexity, enabling the AV to navigate the workspace more efficiently and accurately. LiDAR data is then used to detect the surrounding environment, facilitating the construction of a dynamically constrained Delaunay Triangulation (D2T). The D2T focuses on the local area and surrounding obstacles' movements, optimizing computational costs by considering only the LiDAR range. This approach enables real-time navigation and mapping updates.

For generating near-optimal paths, the research employs an Improved Ant Colony Optimization (iACO) algorithm, a nature-inspired intelligence method, utilizing the D2T graph. The iACO algorithm enhances the search and distribution strategy of the agents (ants), identifying multiple candidate solutions through a greedy search-based algorithm scheme. This enables the AV to navigate complex environments efficiently while exploring various possible routes to reach its destination. By addressing the inherent challenges of AV navigation and mapping, this methodology contributes to advancing autonomous systems' capabilities, promoting safer and more efficient power plant operations, and safeguarding the environment and surrounding communities.

The proposed navigation and mapping approach undergoes validation through simulation and comparison studies, demonstrating its effectiveness and robustness in handling AV positioning challenges and graph connectivity issues. The results underscore the model's ability to provide accurate and continuous data gathering, ensuring seamless security surveillance, and enabling reliable radiation detection within power station environments.

Presenter: Joseph Newell

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Kelly Marsh; Professor of English

Title: Endearment and Infantilization in A Room with a View

Abstract: E.M. Forster's A Room with a View is thought of as somewhat ahead of its time in depicting a woman character's liberation. However, though some scholars argue for an emancipated Lucy, the interactions that shape Lucy and propel her toward freedom tell a different story. My analysis suggests that Lucy's liberty is not plausible. I show that Lucy is infantilized under the cover of endearment by characters who dictate her thoughts and actions. I argue that the patterns of language in those interactions institute Lucy's infantilization and reveal that the display of endearment or interest the other characters invest in Lucy is a channel for her subordination. Her dependency on multiple characters like Charlotte, Cecil, and George sustains a childlike Lucy who relies on the thoughts and order of others, stripping away from her individuality and silencing her voice beyond what she recognizes. The language in Lucy's interactions with characters reveals the impact infantilization has on her ability to achieve freedom—traditionalism and infantilizing language in displays of endearment obscure Forster's vision of an emancipated Lucy.

Presenter: Jacob Hurwitz

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Zachary Gillen

Title: WHY WE SHOULD NORMALIZE DATA: EXPLORING DIVERSE TECHNIQUES FOR DATA NORMALIZATION

Abstract: Data normalization is a critical preprocessing step in data analysis and machine learning and is aimed at standardizing the data that enhances model performance and simplifies interpretation. This abstract presents an overview of a few data normalization techniques. This includes methods such as Min/Max Scaling, Z-Scores, Robust Normalizing, Log Transformation, Power Transformation, and Decimal Scaling, each with its unique characteristics and use cases. Min/Max Scaling rescales data to a specific range, typically 0 to 1, making it suitable for algorithms sensitive to input value ranges. Z-scores transform data to have a mean of 0 and a standard deviation of 1, facilitating comparison and interpretation of data in a standardized form. Robust Normalizing, based on the median and interquartile range (IQR), is strong to outliers and is particularly useful when dealing with data containing extreme values. Log Transformation and Power Transformation alter data distribution, allowing for a more linear relationship with the target variable in cases of nonlinearity. Decimal Scaling involves scaling data by a factor of 10 raised to a specified power, simplifying data representation while preserving its inherent characteristics. Each of these techniques offers unique advantages, and the choice of normalization method depends on the specific dataset and analysis goals. Understanding and appropriately applying these data normalization techniques is important for achieving accurate and meaningful results in data analysis and machine learning tasks. Normalization of data in sports performance is crucial for facilitating different data types, such as distances, times, and scores, on the same scale, enabling meaningful statistical analysis, performance metrics, athletic profiling, and testing parameters. This abstract provides a foundational understanding of these methods, aiding researchers and practitioners in selecting the most suitable normalization technique for their data and objectives.

Presenter: Md Nurul Islam

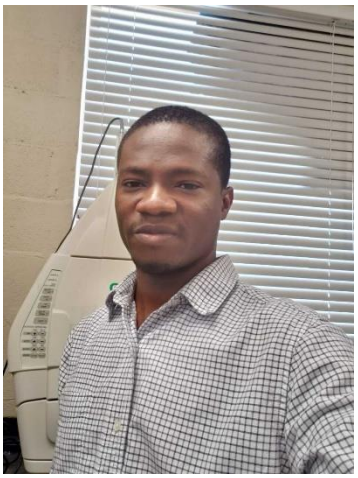
Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Brandon Cline, John "Nutie" and Edie Dowdle Professor of Finance, Department of Finance and Economics

Title: Politician Stock Trading Filing Violations: Oversight or Deliberate Exploitation of Private Information?

Abstract: This paper examines the financial disclosure data of U.S. politicians to determine whether they deliberately violate the STOCK Act of 2012 reporting requirements to conceal and exploit private information. Empirical analysis reveals that 37.79% of politician trades are filed after the required deadline of 45 days mandated by the STOCK Act. The paper further establishes that delinquent filings are not mere coincidence but deliberate efforts to conceal and exploit private information. Notably, purchase violations earn 0.33% higher abnormal returns over a subsequent 10-day period. The study also finds that politicians' attributes influence their tendency to violate. Additionally, the results suggest that politicians earn significantly higher abnormal returns when they trade derivative securities compared to stocks. The positive effect on abnormal returns is amplified when they report such transactions after the required deadline of 45 days.



Presenter: Oladayo Apalowo

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Wen-Hsing Cheng, Department of Food Science, Nutrition and Health Promotion

Title: Exploring the Role of Selenoprotein H on Selenium Distribution, Selenoprotein Expression, and Insulin Signaling in Aged Mice

Abstract: Earlier studies have reported that healthspan deterioration may be associated with reduced expression of certain low-hierarchy selenoproteins, which are preferentially degraded when the body is moderately deficient in selenium (Se). Known age-related chronic diseases in relation to reduced body Se status include cancer, cardiovascular disease, and type 2 diabetes. Cell studies have identified the role of selenoprotein H (SELENOH), a low-hierarchy selenoprotein, in redox regulation and suppressing cellular senescence. Hence, we explore the impact of SELENOH knockout on body Se distribution, selenoprotein expression, and insulin signaling in mice. A total of thirty-six (n = 6) wildtype (Selenoh+/+), SELENOH heterozygous knockout (Selenoh+/-), and SELENOH knockout (Selenoh-/-) mice on a C57BL/6 background were raised till they reached maturity (9 months) or old age (18 months). Mice were kept under specific-pathogen-free conditions in individually ventilated cages within an animal room (22 °C, 12-h dark: light cycle) and had ad libitum access to food and water until they were anesthetized with carbon dioxide and killed by exsanguination via cardiac puncture. The liver and muscle samples were collected and stored at -80ºC for Western and Se concentration analysis. Elemental analysis of Se was carried out using inductively coupled plasma–mass spectrometry (ICP-MS). Insulin signaling was evaluated through thymoma viral proto-oncogene (AKT) phosphorylation on threonine 308. Body Se status was assessed by GPX1, SELENOP, SELENOW, TXNRD1, and TXNRD2 protein expressions. The independent effects (genotype, age) and their interactions were estimated using a 2 x 2 factorial design by SAS version 9.4. ICP-MS results showed reduced ($P < 0.05$) Se concentration by SELENOH knockout in the muscle and by age in the liver. Further, Selenoh-/- mice aged 9 months but not 18 months displayed reduced muscle Se concentration in comparison to wild-type mice. AKT phosphorylation on threonine 308 was reduced by 1) Selenoh+/- or Selenoh-/- in the liver of 18-month-old mice and the muscle of 9-month-old mice; 2) by age in the muscle of wild-type mice. Western analysis results of selenoproteins will be displayed in the symposium.

Presenter: Gabriel F. Nyen

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Adam D. Polinko - Assistant Professor - Forestry Department

Title: Down on Our Knees Hunting for Trees

Abstract: Modern forestry demands that multiple ecological and economic objectives are met by forest managers across space and time. For landowners within the Southeastern USA, some of these objectives are met through the conversion of longleaf pine (Pinus palustris Mill.) plantations to uneven-aged stands. Silvicultural strategies need to be developed to transition plantations to uneven-aged stands by increasing the amount of natural regeneration per local site conditions. We measured regeneration in stands that were disturbed by both commercial thinning in 2015 and Hurricane Michael in 2018. Our results are informed by an inventory of naturally regenerated seedlings found within eight similarly aged longleaf pine plantations at The Jones Center at Ichauway in southwestern Georgia. We created a model for seedling density based on environmental data collected in the field during the summer of 2023. Our findings indicate that lowering densities of understory species can promote natural regeneration and the development of a multi-cohort stand on former agricultural lands planted to longleaf pine.

Presenter: Kelechi Godwin Ibeh

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Austin Himes (Assistant Professor, Forestry Department)

Title: Evaluation of ecosystem response to silvicultural treatments in upland oak forests in northern Mississippi.

Abstract: Upland hardwood forests of northern Mississippi are important habitats for wildlife and have significant ecological, economic, and cultural values. These forests are dominated by oak-hickory and mixed pine-hardwood forest types with other species such as red maple, sweetgum, and ash found in both open woodland and closed-canopy forest conditions. The regeneration of hardwood species, particularly oaks, is essential for maintaining forest diversity and functioning. However, oak regeneration has declined in many upland hardwood forests. This study aims to evaluate the ecosystem response to silvicultural treatments in upland oak forests in northern Mississippi. The study will be conducted at the Spirit Hills Farm, a mixed upland hardwood forest in Tate County, Mississippi. The study area consists of multiple hardwoods and mixed pine-hardwood stands. The study will use a randomized block design to compare three silvicultural treatments: uniform shelterwood (hack and squirt + overstory removal to residual basal area of 50-60 ft2/ac), irregular shelterwood (hack and squirt + overstory removal to residual basal area of 30-40 ft2/ac), and no treatment. The study is focused on monitoring forest ecosystems in terms of residual tree growth, regeneration, seedling recruitment, and diversity. It will also assess trade-offs between multiple ecosystem services in response to each silvicultural treatment, including timber production, carbon sequestration, and wildlife habitat. This study is expected to provide valuable information for developing effective forest management strategies to promote upland oak regeneration and restoration in northern Mississippi.

Presenter: Segun M. Adeyemo

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Joshua J. Granger, Forestry Department

Title: Habitat Suitability Modeling: A Tool for Restoring Butternut, Juglans Cinerea L., in the Eastern United States.

Abstract: The rapid decline of suitable habitat and attacks from the introduced fungal pathogen, Ophiognomoniaclavigignenti-juglandacearum (Oc-j), have been identified as the two primary threats hindering the successful restoration of butternut, Juglans cinerea L., a multi-purpose highly valued native hardwood in the eastern United State and Southeast Canada. Efforts have focused on the conservation and restoration of the butternut population through developing disease-resistant cultivars and restoring identified habitats. Researchers have developed various habitat suitability models and range shift analyses. However, limitations such as un-robust modeling techniques, limited variable selection, and limited geographical range analyses have largely impacted these models' usefulness. Our study bridged this knowledge gap by developing a habitat suitability model with ensemble modeling techniques and variables that represent the full required habitat conditions needed for successful butternut regeneration and identifying sites where butternut is largely abundant throughout its range in the eastern US. This study will also assess the range shift rate, especially at the range edge to identify the need to conserve the native gene pool, potential restoration sites, and future projections on suitable habitats and range shifts.

Presenter: TJ Gatlin

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Joshua Granger, Assistant Professor, Department of Forestry

Title: Hardwood seedling establishment and survival for aid in restoring and enriching bottomland hardwoods in the Lower Mississippi Alluvial Valley

Abstract: Degradation and deforestation have taken their toll on bottomland hardwood forests in the Lower Mississippi Alluvial Valley (LMAV). To combat this, many landowners, both public and private, have sought after silvicultural techniques to ensure future generations can reap the benefits bottomland hardwoods provide. This study aimed to determine what effect artificial regeneration through handplanting of native bottomland hardwood species had on restoring and enriching these forests. This study established the basis for a long-term resource inventory to measure restoration response. Seven bottomland hardwood species native to the LMAV were planted. Species included are water oak, willow oak, Nuttall oak, swamp chestnut oak, overcup oak, cherrybark oak, and red mulberry. These species were planted in a ten foot by ten foot (3.048 meters by 3.048 meters) spacing with one species per row. The primary goal of this study was to determine how well native bottomland hardwoods can be artificially regenerated through handplanting bareroot seedlings in underplanting and open field scenarios within the LMAV by surveying the survival of the seedlings in each scenario.

Presenter: Sushma Bhattarai

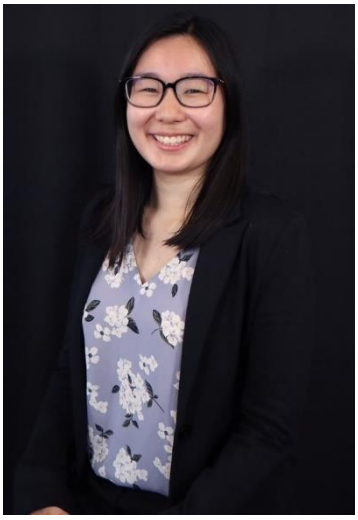
Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Rober K. Grala, Department of Forestry

Title: Landowners' Preference for Chronic Wasting Disease Management

Abstract: Chronic wasting disease (CWD), a fatal transmissible disease affecting species of the Cervidae family, poses a significant risk to private landowners who lease their land for hunting purposes. Research has indicated a decline in hunting activities in areas of the United States with a high prevalence of CWD. The effective management of the disease requires the engagement of private landowners, particularly in the Southern United States, where the majority of forested lands are privately owned. However, little is known about the landowners' preference for the incentives related to the adoption of best management practices to control CWD. This study aims to determine private landowners' preference for implementing CWD control activities on their lands by investigating landowners' behavior in the two states of the Southern US: Tennessee and Mississippi. A discrete choice experiment will be conducted to discern landowners' willingness to accept monetary compensation for implementing CWD management activities on their properties. A mixed logit model which accounts for the individual-level heterogeneity will be used to estimate the marginal willingness to accept for CWD management. The findings from this study will be valuable in informing wildlife managers about developing more effective strategies to increase landowner participation in CWD management.



Presenter: Casey Iwamoto

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Courtney Siegert, Department of Forestry

Title: Sustainable pathways for shortleaf pine (Pinus echinata) in uncertain climates

Abstract: Throughout the southeastern US, strip mining has left degraded and low productivity soils. Combinations of biochar and microbial soil amendments may enhance restoration through increasing carbon sequestration, reducing erosion, and immobilizing heavy metals. In the face of climatic uncertainty, there is a need to understand how the sustainability of current restoration efforts may be impacted in the future to protect soil health and water quality. Precipitation uncertainty due to climate change may challenge the effectiveness of our existing restoration techniques. This study represents a comprehensive greenhouse experiment for shortleaf pine (Pinus echinata) restoration with consideration to climate change under different moisture regimes: dry and wet. Replicates across moisture treatments received the following amendments: biochar, microbial, mixture of biochar and microbial, unamended control, or control with no trees. Soil health indicators (electrical conductivity, pH, and carbon and nitrogen content), tree growth parameters (survival, ground line diameter, height), and soil-water fluxes (dissolved organic carbon, specific ultraviolet absorbance at 254 nm) were measured throughout the study.

Results showed that the microbial amendment and the mixture of biochar and the microbial amendment positively impacted all soil health indicators, tree growth parameters, and soil-water fluxes. The microbial and mixture seemed to mitigate negative changes in soil health indicators in the dry water regime. These changes support the use of microbial inoculants for shortleaf pine restoration on post-mined soils and could alleviate the stress related to future drought conditions in the short term.

Presenter: Elizabeth Esser

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Ashley Schulz

Title: Triploids, Tetraploids, and Hexaploids, Oh My! Cogongrass Ploidy Distribution Throughout the Invaded Range

Abstract: Cogongrass (Imperata cylindrica) is one of the worst invasive plants impacting the southeastern United States, where it threatens native biodiversity and economic productivity by forming dense monocultures, altering fire behavior and regimes, and is a major obstacle to restoration and afforestation efforts. Unlike many invasive plants that only have one ploidy level in the invaded range, cogongrass has been shown to have high levels of genetic diversity and has been found to be variable in ploidy, including diploid, triploid, tetraploid, or hexaploid in the invaded range of the southeastern United States. The effectiveness of cogongrass management could be variable due to cogongrass ploidy level; however, only preliminary research has been conducted to assess ploidy levels. The potential impact regarding the spatial distribution or ecological implications of variable ploidy on its spread and management has yet to be studied. Microsatellites have been successfully used to identify ploidy in other plants, but microsatellites have not yet been tested for ploidy identification in cogongrass. This study investigates potential use of microsatellite markers to map the spatial distribution of cogongrass's variable ploidy in the invaded ranges. Preliminary results from this study will be presented and discussed. We predict that microsatellite markers will be capable of detecting ploidy in cogongrass, and we will use accessions with known ploidy levels previously determined by flow cytometry and squashes of meristematic tissues to test accuracy of these microsatellite markers. Understanding ploidy distribution may help target and refine control efforts by identifying populations that have higher or a diversity of ploidy levels and thus may possess higher genetic diversity, and therefore, adaptive capacity, which could increase the likelihood of invasion success or resistance to management.

Presenter: Mohammad Shakiul Islam

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Padmanava Dash

Title: Estimation of Chlorophyll-a in Uncrewed Aircraft Systems Imagery using Autonomous Surface Vessel data by employing Machine Learning Algorithms and Innovative Feature Selection Approaches

Abstract: Chlorophyll-a (Chl-a) is one of the prime biological indicators that represents the eutrophic state of water bodies. Therefore, its comprehensive characterization and continued monitoring is critical. This paper investigated the ability of 10 commonly used Machine Learning (ML) algorithms to capture the spatio-temporal variations of Chl-a in the Western Mississippi Sound (WMS). An uncrewed aircraft system (UAS) and an autonomous surface vessel (ASV) were used to collect data for development of algorithms to estimate Chl-a. Initially, a comprehensive list of 85 variables was generated using individual bands, band ratios, vegetation indices, and three-band indices in the UAS imagery. They were evaluated using two innovative feature selection techniques, sequential backward feature selection (SBFS) and exhaustive feature selection (EFS). These techniques transform the original d-dimensional feature space into a k-dimensional feature space by iterating through all possible combinations of features and selecting the best feature subset with the highest R-squared (R2) score for each ML algorithm. Additionally, root-mean square difference (RMSD), unbiased mean absolute relative difference (UMARD), and the average percentage difference (APD) were used as performance indicators. Of the 10 ML algorithms, the extreme gradient boosting algorithm demonstrated superior performance, achieving the highest R2 of 0.848. The algorithm's RMSD, UMARD, and APD values were 0.538 µg/l, 0.407 µg/l, and 9.83%, respectively, using a combination of 2 band ratios, 3 vegetation indices, and 3 three-band indices. The method formulated in this study will aid in monitoring Chl-a in coastal waters of the WMS using UAS imagery, while the approaches used will provide a methodology for forthcoming initiatives aimed at robust water quality monitoring in other coastal regions.

Presenter: Christiana Eziashi

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr Varun Paul

Title: Effects of Nutrients and Salinity on Water Quality and Ecosystem of the Western Mississippi Sound

Abstract: ABSTARCT

Coastal environments are exposed to human and natural activities, which negatively impact water quality. Surface water samples were collected from a human-crewed boat, and surface water quality data was collected using a novel autonomous surface vessel (ASV) in the Western Mississippi Sound (WMS) from 29 and 19 stations in the summer of 2021 and 2022, respectively. The Nutrient, salinity, and chl-a data in these samples were analyzed and compared. The salinity varied between 2.4 PSU and 22.9 PSU, suggesting a temporal variation in freshwater contributions from the Mississippi River, Pearl River, St. Louis Bay outflow, Biloxi River, Pascagoula River, and Mobile Bay, following precipitation events leading to nutrient transport and dilution of the salinity in the WMS. Nutrient concentrations were 0.11 - 660 µg/L and 74 - 151 µg/L for nitrate in summer 2021 and fall 2022, respectively, 54.13 - 85.47 µg/L and 74 - 113 µg/L for phosphate in summer 2021 and fall 2022, respectively. Ammonium ranged between 0.00 - 660 µg/L and 4.15 - 139 µg/L in the summer of 2021 and fall of 2022, respectively. Based on the ASV data, salinity is inversely related to chl-a. Plots of salinity against chl-a show a relative increase in the concentration of chl-a with a decrease in salinity, which can be attributed to freshwater-laden nutrients causing an increase in phytoplankton biomass. Plots of salinity against nutrients show negative correlations in the summer of 2021 and 2022, except ammonium, in the summer of 2022. Future studies would address the relationship between nutrients and trace metals, and their impacts on the Mississippi Sound, to estimate pollution status and possible remediation strategies.

Presenter: Zihan Li

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Jing Hu, assistant research professor,GRI

Title: Cover crops effects on nitrous oxide flux during growing season in Mississippi corn cropping system

Abstract: Agroecosystems account for the largest source of anthropogenic nitrous oxide (N2O) flux. Cover crops (CC) demonstrated many positive effects on soil health but showed inconsistent impacts on greenhouse gas emissions (GHG) from the previous studies. N2O flux from arable soil is influenced by climatic region and agricultural management. The objective of this study was to investigate the main factors that affect soil N2O flux and improve the understanding of how different CC treatments affect soil N2O flux by altering soil properties during the CC growing season in Mississippi. A field study was conducted with three species of CC, including Elbon rye (Secule cereal L.), Austrian winter pea peas (Pisum sativum L), and Daikon radish (Raphanus sativus var. nigra). Subplots were monoculture rye and pea, and mixed cultivated these three CC and rotation above CC treatments in each year. We observed cumulative N2O flux ranged from 0.05 ± 0.01 to 0.10 ± 0.01 g N m-2 days-1 during this period, with rotation Elbon rye (R_Rye) treatment soil lowest value and rotation Austrian winter peas (R_Peas) treatment soil highest value. Both CC treatments ($p < 0.001$) and sampling dates ($p < 0.05$) had significant effects on soil N2O flux. A strong positive relationship between N2O flux and NO3-N ($r= 0.33$, $p < 0.05$), together with high soil moisture during the CC growing season, indicated that denitrification was likely to be the main contributor to soil N2O fluxes. Rye and R_Rye treatment soil had the lower NO3-N content (0.31 ± 0.002 mg kg-1, 0.34 ± 0.068 mg kg-1) and N2O flux (0.13 ± 0.035, 0.13 ± 0.029 nmol m-2 s-1, respectively), probably due to a lack of available substrate NO3-N for denitrification. Our results suggest that rye could potentially reduce soil N2O flux during CC growing season, especially in nitrogen limited soil Future study is needed to conduct long-term measurements of soil N2O flux and corresponding soil properties.

Presenter: Mahathir Mohammad Bappy

Level of Study: PhD

Category: Engineering

Advisor: Dr. Wenmeng Tian

Title: Adaptive Thermal History Deidentification for Privacy-preserving Process-defect Modeling of Metal Additive Manufacturing

Abstract: In networked additive manufacturing (AM) systems, sharing process data across multiple users can provide small to medium-sized manufacturers (SMMs) with enlarged training data for part certification, facilitating accelerated adoption of metal-based AM technologies. The aggregated data can be used to develop a process-defect model that is more precise, reliable, and adaptable. However, the AM process data often contains sensitive design information regarding printing path trajectories which is unfortunately subject to confidential product design information leakage when shared among different users during data aggregation. In this study, a new adaptive process data deidentification method is proposed that masks the confidential printing trajectory information embedded in process data in the form of melt pool images in metal-based AM processes. This method generates surrogate melt pool images by masking the instantaneous printing path trajectory as the privacy attribute while retaining the utility attributes for process-defect modeling after data aggregation. More specifically, this approach integrates stochastic image augmentation (SIA) in the adaptive surrogate image generation (ASIG) via tracking melt pool geometric changes. A convolutional neural network (CNN) classifier is used to evaluate the proposed method regarding privacy gain (i.e., identifying printing orientations) and utility loss (i.e., detecting process anomalies). The proposed method is validated using data collected from two cylindrical specimens

using the directed energy deposition (DED) process. The results show that the deidentified dataset significantly improved privacy while sacrificing little or no data utility.

Presenter: Abdur Rahman

Level of Study: PhD

Category: Engineering

Advisor: Haifeng Wang (Assistant Professor, ISE Department)

Title: MoistNet: Machine Vision-based Deep Learning Models for Wood Chip Moisture Content Measurement

Abstract: Quick and reliable measurement of wood chip moisture content is an everlasting problem for numerous forest-reliant industries such as biofuel, pulp and paper, and bio-refineries. Moisture content is a critical attribute of wood chips due to its direct relationship with the final product quality. Conventional techniques for determining moisture content, such as oven-drying, possess some drawbacks in terms of their time-consuming nature, potential sample damage, and lack of real-time feasibility. Furthermore, alternative techniques, including NIR spectroscopy, electrical capacitance, X-rays, and microwaves, have demonstrated potential; nevertheless, they are still constrained by issues related to portability, precision, and the expense of the required equipment. This study explores the use of deep learning and machine vision to predict moisture content from RGB images of wood chips. A large-scale image dataset comprising 1,600 RGB images of wood chips has been collected and annotated with ground truth labels, utilizing the results of the oven-drying technique. Two high-performing neural networks, MoistNetLite and MoistNetMax, have been developed leveraging Neural Architecture Search (NAS) and hyperparameter optimization. The models are evaluated and compared with state-of-the-art deep learning models. Results demonstrate that MoistNetLite achieves 87% accuracy with minimal computational overhead, while MoistNetMax exhibits exceptional precision with a 91% accuracy in wood chip moisture content prediction. With improved accuracy (9.6% improvement in accuracy by MoistNetMax compared to the best baseline model ResNet152V2) and faster prediction speed (MoistNetLite being twice as fast as MobileNet), our proposed MoistNet models hold great promise for the wood chip processing industry to be efficiently deployed on portable devices, such as smartphones.

Presenter: Mahathir Mohammad Bappy

Level of Study: PhD

Category: Engineering

Advisor: Dr. Wenmeng Tian

Title: Parameter Optimization for Accurate and Repeatable Manufacturing of 3D Printed Composite Bone Scaffolds

Abstract: Critically-sized bone defects present a significant challenge to orthopedic surgeons due to the limited availability of autograft bone tissue, which is the current gold standard treatment. As an alternative, 3D bio-printed porous scaffolds can be designed to mimic bone's mechanical and biochemical properties to support tissue regeneration. However, achieving high geometric accuracy and repeatability of these scaffolds can be challenging, especially when printing new composite materials and geometries. Therefore, the objective of this study was optimization of the extrusion-based 3D bioprinting process parameters for composite polymer-ceramic scaffolds. Bone scaffolds composed of a polylactic-co-glycolic acid (PLGA) and 5% nanohydroxyapatite (nHA) composite were printed and analyzed to evaluate their dimensional accuracy, which is primarily determined by

the process parameters. This empirical study investigated the effects of different process parameters, particularly, nozzle temperature, pressure, and printing speed, on the geometric accuracy (i.e., strut thickness) of the printed scaffolds. Starting with a full factorial design of experiments, in-situ layer-wise optical images were captured, which were then leveraged through

image processing for strut thickness characterization. Subsequently, a new iterative process optimization method was proposed that involves regression modeling and bound constraints-based minimization. A case study on printing a two-layer scaffold was used to demonstrate the effectiveness of the proposed method. Overall, the geometric accuracy of the printed scaffolds improved significantly maintaining a range of ±5% from the nominal strut thickness as iterative experiments were conducted, which demonstrates the great potential of the proposed method in bioprinting process parameter optimization.

Presenter: Abdur Rahman

Level of Study: PhD

Category: Engineering

Advisor: Haifeng Wang (Assistant Professor, ISE Department)

Title: Prediction of Genotype and Phenotype Association Using Image Based Encoding

Abstract: In this study, we introduce an innovative approach to predict genotype-phenotype associations using deep learning. By transforming lengthy genomic sequences into RGB images, we leverage an image-based genotype encoding technique. These encoded images are then employed to train a straightforward Multi-Layer Perceptron (MLP) model as a phenotypic trait classifier. We evaluate the model's performance using the Area Under the Receiver Operating Characteristic Curve (AUC) score and utilize sliding windows to pinpoint significant genomic loci. Our results demonstrate the remarkable potential of this approach for genome-wide association studies, offering a promising avenue for unraveling the genetic underpinnings of observable traits.

Presenter: Morgan Wood

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Zachary Gillen

Title: Ammonia Inhalants Do Not Improve Fatigability During Endurance Exercise

Abstract: Background: Ammonia Inhalants (i.e. smelling salts) are a popular ergogenic aid typically used by powerlifting and bodybuilding athletes that have also been used by other populations, including clinical patients. The goal of smelling salts is typically to improve muscle strength, power, and endurance during exercise. Although it has been proposed to help improve acute bouts of muscle strength and power production, and potentially have psychological benefits, it is unclear if it provides any ergogenic effect for muscle endurance (fatigue). The purpose of this study was to examine the effects of an ammonia inhalant on muscular fatigue.

Methods: Nineteen college aged males and females participated in this study (mean±standard deviation, height=176±11cm, weight=76±18kg). Across three trials separated by at least 48 hours, participants inhaled either an ammonia inhalant, placebo (menthol), or no inhalant directly before a fatigue test. For the ammonia inhalant and placebo trials, the substance was placed in an opaque dram with a cotton ball placed over the substance. For the control trial, a cotton ball was placed in the dram with no substance beneath it. For all trials, the dram was held open10cm from the participant's nose, and they were instructed to inhale through the nose for 3-seconds. Immediately after the 3-secont inhalation, participants completed the fatiguing test. The fatiguing test consisted of 50 maximal isokinetic leg extensions and flexions at an angular velocity of 180°·s-1. Peak torque (PT) and mean power (MP) were averaged across the first three repetitions (initial) and last three repetitions (final). Repeated measures ANOVAs examined the effects of each condition (ammonia inhalant vs. placebo vs. menthol) on initial vs. final PT and MP.

Results: PT and MP decreased from initial to final ($p < 0.001$), however, there were no differences across conditions ($p \geq 0.167$).

Conclusion: Although it has been proposed that ammonia inhalants may promote acute improvements in muscle strength and power, it does not seem to improve fatigability. Thus, it is possible the acute improvements in performance from ammonia inhalants are more efficient during short-burst activities of high strength and power output rather than longer duration activities.

Presenter: Russell Lowell

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Zachary Gillen

Title: Changes in countermovement jump performance across the preseason and season in Division 1 basketball players

Abstract: Basketball is a physically demanding sport that requires players to compete in repeated bouts of sprinting, jumping, and lateral shifting. Between practices, games, and strength and conditioning sessions, there are numerous repeated bouts of maximal and submaximal exertion which accumulate over a season, potentially increasing player load. Recently, the countermovement jump (CMJ) has been utilized to monitor athletic performance and player readiness in various sports. Thus, it stands to reason that examining changes in CMJ performance throughout a season may provide insight into maximizing athletic performance and mitigating fatigue. The purpose of this study was to examine the changes in CMJ performance across a preseason and season in Division 1 basketball players. METHODS: A sample of n=10 Division 1 basketball players completed regular CMJ assessments throughout the preseason and season (August through April). Players completed CMJ assessments twice per week, and data were averaged across all attempts within each month. Metrics taken were jump height (JH), reactive strength index (RSI), peak relative propulsive power (PRPP), peak relative propulsive force (PRPF), and braking rate of force development (BRFD), which are commonly used to assess CMJ performance. Repeated measures ANOVAs assessed month-to-month changes in CMJ metrics. RESULTS: JH increased from August to September ($p=0.012$) and plateaued from September to April ($p\geq0.139$). RSI was the same for August to September ($p=1.000$), decreased from September to October ($p=0.005$), plateaued from October to March ($p=1.000$), and increased from March to April ($p=0.010$). PRPP, PRPF, and BRFD remained the same from August to April ($p\geq0.238$). CONCLUSIONS: The present results suggest that commonly assessed CMJ performance metrics (JH and RSI) may be sensitive to changes across a preseason and season for Division 1 college basketball, while force-derived metrics (PRPP, PRPF, and BRFD) may be less sensitive to these changes. Thus, consistent monitoring of JH and RSI may provide information regarding performance improvements and/or decrements in Division 1 basketball players, particularly when examining changes from preseason (August and September) to season (October and onward). Nevertheless, future studies should consider further examination of CMJ metrics to better understand the usefulness of the CMJ to monitor performance in basketball players.

Presenter: Maria Haider

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Stamatis Agiovlasitis, Department of Kinesiology

Title: GENEACTIV ACCELEROMETER CUT POINTS FOR ADULTS WITH DOWN SYNDROME

Abstract: BACKGROUND: Accelerometer cut-points specific to adults with Down syndrome (DS) may improve the measurement of physical activity and sedentary behavior in this population. The purpose of the study was to generate cut-points for sedentary behavior and moderate and vigorous PA for adults with DS based on raw acceleration data from a GENEactiv hip accelerometer. METHODS: Thirty-five adults with DS (age 35 ± 8 years; 19 men) performed 17 tasks each lasting 6 min: sitting; watching a movie; playing app on tablet; drawing; standing; folding clothes; vacuuming; sweeping; moving a box; basketball; soccer; fitness circuit; dancing; walking at the preferred speed and at 0.8 and 1.4 m.s-1; and running. Oxygen uptake was measured with portable calorimetry (K5, Cosmed). One metabolic equivalent (MET) was operationalized as VO2 during sitting allowing for determination of METs during each task. A GENEactiv accelerometer worn on the non-dominant hip was used to determine the Vector Magnitude of raw acceleration data. Vector Magnitude cut-points for sedentary behavior (≤1.5 METs while sitting) and for moderate (3.0¬-5.9 METs) and vigorous (≥6 METs) physical activity were determined with Receiver Operating Characteristic (ROC) curves. Classification performance was evaluated with the area under the ROC curve. Youden’s index was used to identify optimal cut-points maximizing sensitivity and specificity. RESULTS: Area under the ROC curve was: (a) sedentary behavior (0.94; 95% CI: 0.92 – 0.96); (b) moderate physical activity (0.85; 95% CI: 0.82 – 0.87); and (c) vigorous physical activity (0.79; 95% CI: 0.71 – 0.87). Vector Magnitude cut-points were: (a) sedentary behavior ≤160 g·min-1 (sensitivity 1.00; specificity 0.81; Youden’s index 0.81); (b) moderate physical activity ≥320 g·min-1 (sensitivity 0.96; specificity 0.65; Youden’s index 0.61); and (c) vigorous physical activity ≥1211 g·min-1 (sensitivity 0.58; specificity 0.87; Youden’s index 0.45). CONCLUSIONS: ROC models for sedentary behavior and moderate and vigorous physical activity intensity based on raw acceleration data for a hip-worn Geneactiv accelerometer have acceptable classification accuracy in adults with DS.

Presenter: Lauren K. Smith

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Megan E. Holmes, Associate Professor, Department of Kinesiology

Title: INVESTIGATING THE RELATIONSHIP BETWEEN BODY COMPOSITION, PERCEIVED STRESS, AND LIFE SATISFACTION IN MARCHING BAND MEMBERS

Abstract: BACKGROUND: College marching bands are often overlooked in health research, despite their impact on physical activity levels (Sharp et al., 2007; Cowen, 2006). As important mental and physical health indicators, additional investigation is needed to explore the associations between body composition, stress, and life satisfaction in marching band participants. This study examined the association between adiposity and psychosocial well-being in marching band members. METHODS: Anthropometry (height, weight, waist circumference (WC)) was assessed according to standard procedures. Dual-energy X-ray absorptiometry (DXA) determined body composition. Two measures of psychosocial well-being were assessed: Satisfaction with Life Survey (SWLS) and Perceived Stress Scale (PSS). Correlation analyses were used to examine the relationships between all variables, while multiple regression analysis was used to consider the influence of body composition and stress (PSS) on SWLS. RESULTS: 27 participants, consisting of 17 females and 10 males, with an average age of 20.0±1.4, were included in the study (color guard, drumline, and other marching band members). Average body weight was 76.5±18.6 kg, body mass index was 26.5±6.0 kg/m2, and mean body fat % was 31.6±12.0. The average SWLS score was 26.4±4.2, and PSS was 22.8±4.87. PSS and SWLS were inversely associated ($r= -0.61$, $p<0.05$) but not associated with body fat. SWLS was also inversely associated with BMI ($r= -0.44$ and -0.48, respectively, $p<0.05$). Regression analyses showed that PSS significantly predicts SWLS ($\beta= -0.54$, $p<0.05$). This relationship remained unchanged when considering body fat percentage as an additional predictor. CONCLUSIONS: This study investigated the influence of body composition and stress on marching band members' psychosocial health. A significant correlation was observed between the perceived stress levels of marching band members and their overall life satisfaction. Body composition did not change this relationship. Further research is required to better understand this relationship and its potential impact on stress screenings and interventions in the future.

Presenter: Brantley K. Ballenger

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Stamatis Agiovlasitis, Department of Kinesiology

Title: MODERATION OF BODY FAT ON THE RELATIONSHIP BETWEEN AGE AND ARTERIAL STIFFNESS IN DOWN SYNDROME

Abstract: BACKGROUND: Adults with Down syndrome (DS) have high levels of BF% despite attenuated increases in arterial stiffness compared to adults without DS, indicating that BF% may not contribute to increased arterial stiffness in this population. This study investigated the associations between age, BF%, and arterial stiffness, and the moderation of BF% on the relationship between age and arterial stiffness in adults with and without DS. METHODS: Thirty-three adults with DS (age 36□11) and 58 adults without DS (age 28±11) underwent measurements of BF% by bioelectrical impedance and carotid-femoral pulse wave velocity (CF-PWV) by applanation tonometry. Pearson's correlation was used to examine the associations between age, body composition, and arterial stiffness. Moderation analysis was performed to determine if BF% moderates the relationship between age and arterial stiffness in adults with and without DS. RESULTS: Age was significantly associated with BF% (r=.33, p=.006) and CF-PWV (r=.71, p=<.001), and %BF was significantly associated with CF-PWV (r=.43, p<.001) in adults without DS. In adults with DS, age was significantly correlated with CF-PWV (r=.59, p<.001). BF% was not associated with age (r=-.02, p=.453) or CF-PWV (r=.13, p=.233). Moderation analysis showed significant main effects of age (□=.49, 95%CI [.24, .74], p<.001) and BF% (□=.28, 95%CI [.08, .48], p=.007) in adults without DS. Simple slopes analysis demonstrated that, in adults without DS with low BF% (–1SD), age had a non-significant impact on CF-PWV (□=.25, 95%CI [-.22, .72], p=.295). For those with average BF%, age had a significant impact on CF-PWV (□=.49, 95%CI [.24, .74], p<.001) and for those with high BF% (+1SD) the significant impact of age on CF-PWV became even larger (□=.72, 95%CI [.51, .93], p<.001). In adults with DS, the main effect of age on CF-PWV was significant (□=.69, 95%CI [.36, 1.02], p<.001); however, the effect of BF% was not significant (□=.16, 95%CI [-.14, .45], p=.285). CONCLUSION: The relationship between arterial stiffness and %BF differs between adults with and without DS. In adults without DS, increased BF% increases the impact of age on arterial stiffness. Body composition does not appear to significantly contribute to the age-related increases in arterial stiffness in adults with DS.

Presenter: Georgia Starr

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Stamatis Agiovlasitis, Department of Kinesiology

Title: PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR LEVELS AND PATTERNS IN ADULTS WITH AND WITHOUT DOWN SYNDROME

Abstract: BACKGROUND: Low physical activity (PA) and high sedentary behavior (SB) levels in adults with Down syndrome (DS) have been evaluated with accelerometer cut-points for adults without DS. This study examined if levels and patterns of PA or SB differed between adults with and without DS when using population specific accelerometer cut-points. METHODS: Twenty-eight adults with DS (age 37±11 years) and 56 adults without DS (age 29±11) had PA and SB measured by hip worn accelerometer (wGT3X-BT, Actigraph). We scored accelerometer data using the following cut-points (DS: Sedentary ≤237 counts/min-1, Light ≤2166 counts/min-1, Moderate-to-vigorous (MVPA) ≥2167 counts/min-1; Non-DS: Sedentary ≤199 counts/min-1, Light ≤2690 counts/min-1, MVPA ≥2691 counts/min-1). The following thresholds were used for number and duration of SB and PA bouts: ≥1, ≥10, ≥30, and ≥60 min. We used independent samples t-tests to determine differences between adults with and without DS for SB and PA variables. RESULTS: Adults with DS had less sedentary time (DS: 338±96 min/day-1; Non-DS: 502±113 min/day-1; p<.001), more light PA (DS: 330±93 min/day-1; Non-DS: 287±72 min/day-1; p=.012), and more MVPA time (DS: 95±49 min/day-1; Non-DS: 52±28 min/day-1; p<.001) than adults without DS. Adults with DS had more ≥1min (DS: 53±10 bouts/day-1; Non-DS: 44±8 bouts/day-1; p<.001), and less ≥10min (DS: 14±5 bouts/day-1; Non-DS: 17±3 bouts/day-1; p=.002), ≥30min (DS: 2±2 bouts/day-1; Non-DS: 5±2 bouts/day-1; p<.001), and ≥60min SB bouts (DS: .5±.4 bouts/day-1; Non-DS: 1±1 bouts/day-1; p<.001) than adults without DS. Adults with DS had shorter ≥1min (DS: 8±2 min/bout-1; Non-DS: 13±5 min/bout-1; p<.001) and ≥10min SB bouts (DS: 21±6 min/bout-1; Non-DS: 26±7 min/bout-1; p<.001) than adults without DS. Adults with DS had more ≥1min (DS: 35±13 bouts/day-1; Non-DS: 22±9 bouts/day-1; p<.001) and ≥10min PA bouts (DS: 2±2 bouts/day-1; Non-DS: 1±1 bouts/day-1; p<.001), and longer ≥1min (DS: 3±1 min/bout-1; Non-DS: 2±1 min/bout-1; p=.003), but shorter ≥10min PA bouts (DS: 15±3 min/bout-1; Non-DS: 19±9 min/bout-1; p=.010) than adults without DS. CONCLUSION: Adults with DS engage in shorter sedentary bouts than adults without DS that are interrupted by short bouts of PA. Structured activities at group homes and day programs may contribute to more breaks in SB observed among adults with DS.

Presenter: Ricky Earl

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Zachary Gillen

Title: RELATIONSHIPS BETWEEN ANTHROPOMETRIC AND ATHLETIC PERFORMANCE MEASURES IN AMERICAN FOOTBALL OFFENSIVE AND DEFENSIVE LINEMEN.

Abstract: Background: The National Football Association (NFL) records anthropometric and athletic performance data annually. Offensive linemen (OL) and defensive linemen (DL) record the highest body mass indices (BMI), typically being categorized as overweight or obese based on BMI. However, BMI may poorly reflect weight status as it does not consider fat vs. fat-free mass. Therefore, this study examined the differences and relationships in anthropometrics and athletic performance between OL and DL. Methods: OL and DL (n=710, height=193±4cm, body mass=135±11kg, BMI=36±3) from the annual NFL combine between 2017-2023 were assessed. Athletic performance included: 10-yard split (10YS), 20-yard split (20YS), 40-yard dash (40YD), bench press test (BP), vertical jump (VJ), broad jump (BJ), pro agility test (PA), and the L-cone drill (LC). BMI was calculated as body mass (kg) divided by height (m) squared. Independent samples t-tests examined differences between OL and DL. Pearson correlation coefficients examined relationships between anthropometrics and athletic performance for OL and DL. Results: OL had greater anthropometrics than DL ($p<0.001$). DL had better performance for the 10YS, 20YS, 40YD, VJ, BJ, PA, and LC ($p<0.001$). For DL, BMI had moderate to high relationships with 10YS, 20YS, 40YD, VJ, BJ, PA, and LC ($r\geq0.555$) and a low relationship with BP, height had negligible relationships with athletic performance ($r\geq0.171$), and body mass had moderate to high relationships with 10YS, 20YS, 40YD, VJ, BJ, PA, and LC ($r\geq0.548$) and a low relationship with BP ($r=0.311$). For OL, BMI had negligible to low relationships with athletic performance ($r\geq0.165$), height had negligible relationships with BP and PA ($r\geq0.141$), and body mass had negligible to low relationships with 10YS, 20YS, 40YD, VJ, BJ, PA, and LC ($r\geq0.190$). Conclusion: Anthropometrics had greater magnitudes of relationship with athletic performance for DL than OL. Lower BMI and body mass in DL, with better athletic performance and relationships between BMI and performance, may suggest that BMI for DL reflects greater fat-free, rather than fat, mass, which may not be the case for OL. Assessing fat vs. fat-free mass should be considered in this population to accurately assess obesity status and its impact on performance.

Presenter: Samantha Searles

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Zachary Gillen, Assistant Professor of Exercise Physiology, Department of Kinesiology

Title: Sex-based comparisons of isometric and isokinetic hamstrings-to-quadriceps ratio and muscle size

Abstract: BACKGROUND: Hamstrings-to-quadriceps ratio (HTQ) can provide unique information regarding muscle development, training habits, and injury risk, particularly of the knee. As females are typically more prone to knee injuries than males, examining sex-based differences in HTQ may provide insight to the mechanisms causing these differences. The purpose of this study was to compare HTQ during leg extension and flexion contractions in females versus males. METHODS: Twenty-seven females and males (mean□95% confidence interval, n=14 females, age=24□4yrs; n=13 males, age=25□6yrs) participated. Ultrasound images quantified quadriceps, hamstrings, and thigh muscle cross-sectional area (CSA). Peak torque (PT) was taken from maximal voluntary isometric contractions (MVICs) and isokinetic leg extension and flexion contractions from 60-300□□s-1. HTQ was calculated by dividing hamstrings CSA by quadriceps CSA and PT from leg flexion by PT from leg extension for all contractions. Independent samples t-tests examined differences in CSA and HTQ from CSA. Mixed-factorial ANOVAs examined differences in PT and HTQ from PT. RESULTS: Males had larger quadriceps, hamstrings, and thigh CSA, and isometric and isokinetic PT than females for leg extension and flexion across velocity ($p<0.001$). There were no sex-based differences in the HTQ from CSA or PT across velocity (p□0.109). For both groups, leg extension PT decreased from MVIC to 300□□s-1 (p□0.035). For the females, leg flexion PT was the same from MVIC to 60□□s-1 ($p=1.000$), decreased from 60 to 180□□s-1 (p□0.002), and plateaued from 180 to 300□□s-1 (p□0.071). For the males, leg flexion PT decreased from MVIC to 300□□s-1 (p□0.025). For both groups, HTQ increased from MVIC to 60□□s-1 ($p<0.001$), then plateaued from 60 to 300□□s-1 ($p=1.000$). CONCLUSIONS: Both groups had similar patterns of response for leg extension PT and HTQ across velocity, though leg flexion PT for females remained constant from moderate to fast velocities. Thus, factors other than quadriceps and hamstrings muscle size and strength may be responsible for the potential sex-based difference in knee injury risk. Worth noting, among these recreationally-trained participants, HTQ across velocity was □0.59, below the generally recommended ratio of 0.67. It may be beneficial for both females and males to prioritize hamstrings strengthening exercises, as HTQ of <0.67 tend to be associated with greater knee injury risk.

Presenter: Kenzie Hargrove

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. JohnEric Smith, Department of Kinesiology

Title: Sweat Rate and Hydration Assessment in Youth Cross-Country Athletes

Abstract: Background: This was an observational study aimed at assessing sweat rates and hydration status of local youth runners. Cross-country (XC) running is a sport that takes place during some of the hottest months of the year. Thus, the risk of heat-related illness is very present and is potentially higher in youth athletes due to incomplete development of their sweat response. Monitoring these athletes allows researchers and the athletic community to gain deeper understanding of youth athlete responses to heat, thus decreasing the likelihood of heat-related injury and illness. Methods: 25 youth XC runners (age: 14.47 ± 1.46yrs, 11 female, 14 male) participated in this study. Each runner was tested once during August or September during a school-sanctioned XC practice with coaches present. Water bottles were provided and weighed before and after practice. Every athlete was weighed in a private area without socks, shoes, or shirt. One sweat patch was then applied to each forearm of the athlete, with an elastic netting covering the patch. Immediately after practice, athletes were weighed again and patches were removed. Patches were stored in air-tight plastic tubes and wrapped in plastic wrap to decrease risk of evaporation. Samples were analyzed the day of collection. Samples were centrifuged for 10 minutes then analyzed via ion-selective electrode technology. Mean and SD were calculated, and independent sample t-tests were run to compare means between males and females. Results: Average sweat rate was 1.13 ± 0.50 L/h and average sodium loss was 1290 ± 322 mg/h. Average percent body weight lost was 1 ± 1%. There was a significant difference between males and females in sweat rate ($p < 0.05$) and sodium loss ($p = 0.016$), but no difference in %BW lost ($p=0.165$). Conclusions: Both sweat rate and sodium loss are greater than published youth overall norms. This is expected as these published norms are not based specifically on youth cross-country runners. Continued assessments of youth athletes will yield greater understanding of proper hydration strategies for this population. This study provided participants with individualized hydration packets to provide better understanding of the importance of hydration for training and performance.

Presenter: Hunter Derby

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Harish Chander

Title: The Effects of Acute Virtual Reality Exposure on Dynamic Postural Stability

Abstract: BACKGROUND: Postural instability and the inability to regain balance during slip-induced events are recognized as one of the most common cause of falls at the same level in an occupational environment. Additionally, falls are one of the leading causes of injuries and fatalities in the occupational population. With the growing popularity of virtual reality (VR), individuals have the potential to be immersed in a realistic and interactive environment, exposing themselves to various fall-risk hazards without the risk of injury that real-world exposure may cause. Therefore, the purpose of this study was to compare lower extremity joint kinematics about the knee and ankle of the slipping leg during real and virtually generated slip hazards. A secondary purpose was to investigate dynamic postural stability following acute exposure to real (REAL) and virtual (VR) environmental conditions. METHODS: A total of 14 healthy participants [7 males, 7 females; age: 23.46 + 3.31 years; height: 173.85 + 8.48 cm; mass: 82.19 + 11.41 kg; shoe size (men's): 9.03 + 2.71] knee and ankle joint kinematics were compared during exposure to both REAL and VR environments. Participants then completed a series of Timed-Up-And-Go (TUG) variations (standard, cognitive, manual) at the beginning of data collection, then following exposure to each environment. Environmental exposure was selected in a counterbalanced order to prevent an order effect. Knee and ankle joint kinematics were analyzed separately using a 2 x 3 repeated measure ANOVA to compare environments as well as gait types at an alpha level of 0.05. TUG variations were also analyzed separately using a 3 x 3 repeated measures ANOVA to compare TUG variations and environment. RESULTS: Results revealed no significant differences between environments or gait types. There were also no significant interactions observed between environments and gait types. However, significant differences were observed for TUG-C following VR environmental condition. CONCLUSION: Based on the current findings, the lack of significance in lower extremity joint kinematics, as well as the improvement in TUG-C performance following acute VR exposure to slip hazards, demonstrate the potential effectiveness of VR as a means of fall prevention training for occupational populations.

Presenter: Aaron Griffith

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Adam Knight, Professor, Department of Kinesiology

Title: THE Y-BALANCE TEST AS A MEASURE OF DYNAMIC STABILITY AMONG COLLIEGIATE AMERICAN FOOTBALL PLAYERS

Abstract: The Y-Balance Test (YBT) is a widely-used tool for lower extremity injury rehabilitation, focusing on dynamic balance. This test requires individuals to balance on one leg while reaching in three directions: anterior, posteromedial, and posterolateral. Research suggests that shorter reach distances may increase the risk of lower extremity injuries. This study aimed to assess these reach distances in collegiate American football players both before the season and at its midpoint, comparing healthy players to those who sustained lower extremity injuries during the season.

Participants underwent testing twice: once in late July before the season and again in early November during the midseason. They balanced on their right leg, reaching out with their left leg as far as possible in each of the three directions. Composite scores were computed by normalizing reach distances to leg length, summing the three reach directions, dividing by three times the leg length, and multiplying by 100. Participants also reported any lower extremity injuries sustained during the season. A 2x2 repeated measures ANOVA analyzed differences in composite scores.

The results did not reveal a significant interaction between group (injured vs. healthy) and time (preseason vs. midseason), with an F-value of 2.126 ($p = 0.179$). There was also no significant main effect for time ($F = 2.839$, $p = 0.126$), indicating that composite scores did not significantly change over the season (preseason mean = 93.13 ± 7.30 cm; midseason mean = 89.59 ± 11.95 cm). Additionally, there was no significant main effect for group ($F = 1.882$, $p = 0.203$) (healthy mean = 87.42 ± 7.74 cm; injured mean = 94.64 ± 9.38 cm).

In conclusion, this study did not find significant differences in YBT composite scores between healthy and injured collegiate football players or between preseason and midseason assessments. However, it underscores the importance of ongoing monitoring and targeted interventions to enhance lower extremity stability in collegiate football players throughout the season. Future studies should consider larger sample sizes to further investigate these relationships

Presenter: Ian C. Macali

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Dr. Megan E. Holmes Kinesiology

Title: HEALTH CHARACTERISTICS OF MARCHING BAND PARTICIPATION

Abstract: BACKGROUND: Health characteristics of marching band participants are largely ignored, except for the substantial contribution to daily physical activity (PA) (Cowen, 2006). This study examines differences in health characteristics between collegiate marching band members and the general public.

METHODS: Participants were members of a marching band (n=32). Body composition, and total, spinal, and leg bone mineral density (BMD) was determined via DXA. Anthropometry (height, weight, waist circumference) and blood pressure (BP) was assessed. This sample was contrasted with curated NHANES (2017-2018) data to match band demographics, race, and ethnicity. T-tests and X2 analyses were used.

RESULTS: Mean BMI of band members was overweight (26.7 ± 6.7 kg/m2) but mean waist circumference was healthy (84.0 ± 15.6 for men and 82.6 ± 12.9 for women). Both systolic and diastolic BP were considered normotensive (118.2±13.2 mmHg, 73.0±11.6 mmHg, respectively). No significant differences emerged when considering location-specific BMDs, BMI, or WC. Significant differences were observed in systolic BP (118.2±13.2 vs. 112.7±10.0, $p<0.05$), diastolic BP (73.0±11.6 vs. 64.7±9.2, $p<0.05$).

CONCLUSION: Few differences were found between marching band members and NHANES data. BP was higher in band members, which suggests regular BP screening for marching band members may be useful.

Presenter: Ally Cummings

Level of Study: Master's

Category: Engineering

Advisor: Dr. Matthew W. Priddy, Associate Professor, Department of Mechanical Engineering

Title: Effect of Toolpath on the Thermomechanical Response for Finite Element Modeling of Wire-Arc Directed Energy Deposition

Abstract: Wire-arc directed energy deposition (WA-DED) is a metal additive manufacturing method that utilizes a wire feedstock and an electric arc to build parts in a layer-wise welding process. WA-DED demonstrates high deposition rates, minimal material waste, and the ability to produce large-scale components making it of interest to the metal manufacturing industry. Determining parameters for WA-DED builds is typically done through trial-and-error experimentation which is costly. In contrast, finite element (FE) simulations can be used to predict thermal and mechanical histories of parts undergoing WA-DED. These simulations can be used to test a range of potential print parameters thus reducing the experimental iterations required to produce a sufficient part. Toolpath is one parameter that impacts the thermomechanical response of a part. Different toolpaths demonstrate variation in part distortion and mechanical properties. Ultimaker Cura (Cura) software is a more robust slicing software compared to previously available tools of the same utility such as Slic3r. Cura offers an abundance of slicing options including 14 infill patterns that can each be further customized. Though many of the toolpaths are unrealistic or unnecessarily complex for WA-DED, this resource broadens modeling capabilities by enabling relatively easy exploration of various toolpaths and making path planning a supplemental parameter that can further improve manufacturing with WA-DED. In this work, four different toolpaths – classic lines, zigzag, alternating zigzag, and concentric – are evaluated for a 10-layer 70x70x15mm block. The print material is Maraging 250 (M250) steel which is deposited on an A36 steel substrate via FE simulations of WA-DED. The toolpaths are generated in Cura and exported as G-code. The G-code is transformed into XYZ time series data using a Python script, which is subsequently input into Abaqus for FE simulations. The results show variation in thermal and mechanical profiles among the four toolpaths. The concentric toolpath experienced the highest temperature throughout deposition and is expected to display the most deviation from the ideal shape.

Presenter: Matthew Register

Level of Study: PhD

Category: Engineering

Advisor: Matthew Priddy, Associate Professor, Department of Mechanical Engineering

Title: Finite Element Modeling of an Active Cooling Plate Design for Wire-DED of CP-Ti

Abstract: Wire Arc Directed Energy Deposition (W-DED) is an additive manufacturing process which utilizes an electrical arc heat source to melt metal wire in a layer-by-layer fashion to build near net shape parts. As the W-DED process adds material over time, heat accumulates in the part resulting in large thermal gradients. These high thermal gradients result in uneven material expansion and contraction forming residual stresses and geometrical inaccuracies. During printing, most heat is lost via conduction into the built plate, which acts as a heat sink. As the build height increases, cooling rates through conduction become minimized leading to heterogeneous microstructures, varying mechanical properties, and part distortion. Heat accumulation becomes even more apparent when built with materials with low thermal conductivities such as Commercially Pure Titanium (CP-Ti). When printing with CP-Ti, longer dwell times are needed between layers to provide appropriate cooling time resulting in extended print times and may lead to increased production costs. Previous active cooling systems have been attempted for the W-DED process; however, these methods are complex to implement and do not provide long term solutions for a variety of part geometries and W-DED systems. This study focuses on the design of an active cooling plate for the W-DED process to mitigate heat accumulation in large parts made with CP-Ti by increasing the rate of conduction into the build plate. This increased conduction will attempt to mitigate the large heat accumulation to produce more homogenous properties while decreasing the print time. Finite Element (FE) modeling of the W-DED process was performed to predict the thermal response in large CP-Ti parts. With a working FE model, the cooling plate design parameters can be modified and iterated on to fine tune the thermal history according to the part geometry and print strategy. The cooling plate consists of an aluminum plate with water cooled channels flowing throughout. A design of experiments was performed to determine the effect of the number of cooling channels, radius of the cooling channels, and cooling plate depth on the thermal history of the part to improve the cooling plate design.

Presenter: Ashreet Mishra

Level of Study: PhD

Category: Engineering

Advisor: Dr. Like Li

Title: Heat transfer enhancement in particle-based heat exchangers

Abstract: Thermal energy storage (TES) systems based on renewable energy sources (concentrated solar, wind, and photovoltaic) are crucial to reducing dependence on conventional energy generation systems and reducing renewable energy's intermittent nature. TES can be utilized in conjunction with concentrated solar power (CSP) in particle-based power cycles where the particles can be charged (heat addition) using solar energy and then discharged (heat extraction) using particle-based heat exchangers (HX). Efficient particle-based HXs are vital in coupling heat transfer fluid (HTF) from thermal receivers to power cycle working fluid (WF). Heat transfer enhancement is essential for adopting particle-based moving packed-bed heat exchangers (MPBHXs) in next-generation TES systems, as MPBHXs usually exhibit low particle bed-to-wall heat transfer coefficients and total heat transfer.

This presentation focuses on addressing the limitations of MPBHXs by computationally studying the heat transfer performance enhancement due to granular flows in metal foam-based MPBHXs and reactive flow-based MPBHXs. Comprehensive multidimensional, multiscale, and multiphysics models are developed to predict the TES/TCES performance accurately. First, granular flow through metal foam-based particle-to-sCO2 HXs to predict the heat transfer coefficient enhancement. Then, granular flow with reactive and sensible heat-only particles is studied in particle-to-sCO2 HXs to predict the heat transfer enhancement followed by recommendation of optimum parameters.

Presenter: Caitlin Luke

Level of Study: Master's

Category: Engineering

Advisor: Dr. Matthew Priddy, Department of Mechanical Engineering

Title: Modification of benchtop impaction device to mimic cadaveric transforaminal lumbar interbody fusion (TLIF)

Abstract: Lumbar interbody fusion (LIF) requires the removal and replacement of the intervertebral disc in the lumbar spine to treat disc pathologies. This is achieved by inserting an interbody fusion device (IFD) into the disc space via malleting by the surgeon, which can result in intra-operative device failure. The objective of this work was to modify a sensor-outfitted benchtop device to mimic the impact waveform characteristics including peak force, impact duration, and area under the impulse curve, in addition to the number of strikes to full insertion, from cadaveric transforaminal lumbar interbody fusion (TLIF) procedures. A benchtop device previously built by our team for this testing procedure underwent a series of modifications to generate more repeatable results and accelerate the testing process. To replicate IFD insertion, the benchtop device utilized a drop weight that impacted a force-sensor outfitted insertion tool to which the IFD was attached. The 12 mm x 24 mm IFD was inserted between two vertical platens containing SAWBONES® bone foam which applied a constant lateral compressive load of 200 N on each side. Modifications included incorporating compression clamps, button compression sensors, spring guides, frictionless rails, a baseplate, L-brackets, large bolts, new springs with a constant of 63.22 lb/in, and a one-pound aluminum drop weight. Drop height was varied from 60 cm to 120 cm in increments of 10 cm. Data collected from the benchtop device was compared to previously collected cadaveric data via one-way ANOVA and Dunnett's test. All drop height groups successfully replicated average peak force. The 90 cm, 110 cm, and 120 cm groups replicated the impact duration. The 110 cm and 120 cm groups replicated the area of the impulse curve. All three waveform components were matched by both the 110 cm and 120 cm drop height groups. This research validated the use of a sensor-outfitted benchtop impaction device to accurately mimic waveform characteristics of cadaveric TLIF procedures. Overall, the ability to replicate LIF procedures ex vivo and match in situ cadaveric data will aid IFD design, use conditions, and failure analysis to refine LIF surgical techniques.

Co-authors: Alexis Graham, Micah Foster, Halleigh Faulkner, Dani Janus, Tanner Jones, Jerald Redmond, MeLeah A. Henson, Rex Armstrong, Lauren B. Priddy, and Matthew W. Priddy,

Presenter: Sujita Balami

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Matt Griffin, Research Professor, Department of Pathobiology and Population Medicine, CVM

Title: Development and Evaluation of Live-Attenuated Vaccine Candidates Against Edwardsiella piscicida in Blue (Ictalurus furcatus) x Channel Catfish (Ictalurus punctatus) Hybrids

Abstract: Catfish aquaculture is one of the most successful and economically important finfish aquaculture industries in the United States. The majority of US catfish production occurs in Mississippi, followed by Alabama and Arkansas, and to some extent, Louisiana and Texas. The adoption of alternative, more intensive production techniques has been aided by the integration of complementary technologies, such as fixed-paddlewheel aeration, partitioned aquaculture systems, and the utilization of hybrid catfish. Hybrid catfish have gained popularity as an alternative to channel catfish, thanks to their superior growth performance, high feed conversion rates, increased tolerance to low dissolved oxygen, and ease of handling. In addition to these attributes, hybrids have demonstrated enhanced resistance to several channel catfish pathogens. However, the emergence of Edwardsiella piscicida in hybrid catfish aquaculture has raised concerns. Hybrid catfish account for >90% of E. piscicida diagnoses at the Aquatic Research and Diagnostic Laboratory in Stoneville, MS, and outbreaks of E. piscicida have caused significant losses in hybrid production systems. A member of the Hafniaceae family, E. piscicida is recognized as a pathogen affecting approximately 30 different fish species worldwide, resulting in significant economic losses. Despite its impact, there is a limited availability of commercially viable vaccines for E. piscicida, particularly in catfish. To this end, multiple potential live attenuated vaccine candidates were produced and evaluated for their ability to minimize the risk of Edwardsiellosis in hybrid catfish. Multiple genetic variants of E. piscicida identified in previous studies were passed on plates containing increasing concentrations of rifampin, up to 350 µg/mL. A total of 10 mutant strains were developed and tested for attenuation. Initial attenuation tests exposed fish by IP injections of ~1x104 CFU per g of fish. While low-level mortality (<20%) was observed in all wild-type treatments, the mortality rate was negligible in fish inoculated with rifampin-passed mutants. However, this reduction in mortality was statistically significant in only 2 out of the 10 tested strains. Subsequent rechallenge revealed significant protection against E. piscicida isolate S11-285 for 9 of 10 wild-type strains, but only 2 of 10 mutants, possibly a result of the low immunizing dose. The two successful mutants yielded relative percent survival of 74-76%, compared to 77-100% for the wild-type strains. The high level of protection conferred by prior exposure to wild-type strains suggests the potential for successful vaccination against E. piscicida, provided a suitable attenuated candidate can be identified. Future research on these potential vaccine candidates will involve the use of higher initial immunizing doses for attenuation testing and subsequent assessment of their protective potential.

Presenter: Sujita Balami

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Matt Griffin, Research Professor, Department of Pathobiology and Population Medicine

Title: First Report of Streptococcus dysgalactiae subsp. dysgalactiae Associated with Mortality Events in Catfish Aquaculture in Mississippi, USA: A Case Study

Abstract: Catfish aquaculture the largest sector of US finfish aquaculture with sales of $447 million in 2022. Lancefield Serological Group C Streptococcus dysgalactiae (GCSD) is a known fish pathogen in Asia, but until recently has been a pathogen of minimal concern in wild and farmed fish in the United States. In 2018 GCSD was isolated from a fish kill involving feral populations of silver carp in the Mississippi River and in 2022 it was isolated from tilapia reared in an aquaculture facility in Alabama. In 2022 a male channel catfish (Ictalurus punctatus) broodfish was submitted to the Aquatic Research and Diagnostic Laboratory in Stoneville, Mississippi for diagnostic assessment. Pure cultures of Streptococcus dysgalactiae, identified by 16S rRNA gene sequencing, were isolated from the diseased fish, warranting further investigation. Multilocus sequence analysis targeting nine Streptococcus spp. housekeeping genes placed the catfish isolate along with the US isolates from silver carp and tilapia in a clonal group that included isolates from fish kills in Japan. Complete genomes of the catfish isolate, as well as GCSD isolates from the Louisiana Aquatic Diagnostic Laboratory and Aquatic Animal Health Research Unit, Auburn, Alabama were obtained using combinations of short-read (Illumina) and long-read (Oxford Nanopore) platforms. Average nucleotide identity (ANI) and digital DNA-DNA Hybridization (dDDH) estimations were 99% and >95% respectively, indicating isolates from fish are largely clonal and distinct from GCSD isolated from terrestrial animals. However, comparisons to terrestrial GCSD isolates revealed insufficient divergence (97-99% ANI; 81-99% dDDH) to a subspecies designation. In 2023 two more cases of GCSD were isolated from catfish farmed in East and West Mississippi, indicating GCSD is a potential emerging pathogen in Mississippi catfish aquaculture. This study reports the first molecularly confirmed incidence of GCSD in MS catfish aquaculture. Combined, these data indicate a clonal GCSD strain that has an affinity for fish and aquatic systems and is a potential threat to US freshwater aquaculture, including farm-raised catfish.

Presenter: Yukai Ai

Level of Study: PhD

Category: Engineering

Advisor: Chuji Wang, professor, Physics

Title: Characterization of single atmospheric aerosol particles using optical trapping technologies

Abstract: Optical trapping (OT) and manipulation of single nano- and micron-sized particles has become a powerful tool used in diverse research fields, such as physics, chemistry, biology, materials, atmospheric sciences, etc. From the early optical-tweezers approach, which uses a single tightly focused laser beam to levitate dielectric or absorbing micron-sized particles, to the recently developed optical traps such as the universal optical trap, which can trap particles of arbitrary chemical and physical properties in different media, optical trapping has evolved significantly over the last decades. Research in optical trapping has been extended from control of a single-particle, measurements of a single-particle, to the study of chemical reaction in a single-particle. One of the most rapid developments in optical trapping is the combination of optical trapping with advanced laser spectroscopic techniques to achieve on-trap single-particle studies. I will present the most recent updates in single-particle characterization using optical trapping technologies.

Presenter: Manoj Kumar Reddy Allam

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. K. Raja Reddy (Research Professor, Plant and Soil Sciences)

Title: Characterization of Nod Glycine rich proteins in root nodule development of Medicago truncatula

Abstract: Symbiotic nitrogen fixation is an agronomically important biological process that results in natural input of nitrogen into agricultural soils. Legumes and soil bacteria called rhizobia that convert atmospheric nitrogen into readily available ammonia enter a partnership that leads to formation of specialized organs called nodules on legume roots. Small signaling peptides (SSPs) or peptide hormones are emerging regulators of root nodule formation and are fragments of larger polypeptides, that range from five to 65 amino acids. SSPs are classified into subgroups such as post translationally modified peptides, Cystine rich and Glycine Rich Peptides (GRPs). Although there are several studies investigating the first two subgroups, not much is known about the Glycine rich peptides. In the model legume Medicago truncatula there are 57 genes which encode glycine rich proteins, of which three have been implicated in rhizobial infection previously. Glycine rich peptides in nodules range between 60-250 amino acids and are characterized by an N-terminal secretion signal followed by stretches of glycine residues. Our research is focused on the characterization of glycine rich proteins in root nodule development of M. truncatula, as they are induced during nodule development. Of 57 glycine rich protein (NodGRP) genes, MtNodGRP31 is seen to be induced in three out of four time points post inoculation with the rhizobial partner Sinorhizobium meliloti; these include 4dpi, 10dpi, 14dpi and 28dpi. Phylogenetic analysis in MEGA X showed that the genes NodGRP31 belongs to a cluster of 13 closely related, tandemly duplicated genes on chromosome five.

These 13 NodGRPs do not have orthologues in non nodulating plants such as Arabidopsis thaliana or Nelumbo nucifera.

Our research aims to characterize these proteins using molecular genetics and plant phenotyping. Understanding NodGRP function will help provide insights into genetic control of nodule development and rhizobial infection required for optimizing this process.

Presenter: Vijaykumar S Hosahalli

Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Raju Bheemanahalli, Assistant Research Professor, Plant and Soil Sciences

Title: Effect of Biostimulants in Alleviating Heat and Drought Stress in Soybean

Abstract: Soybean cultivation is facing significant challenges due to various stressors. The impact of climate change on plant health is one of the major factors affecting yield potential. Soybean-growing regions are frequently exposed to heat and drought during reproductive stages, leading to lower yields. In recent years, commercially available biological products have been proposed as a sustainable and viable solution to improve soybean productivity under stress. However, there is limited research available on the effectiveness of these products in mitigating stress caused by drought and heat. This study aimed to investigate the effects of different biostimulants, both individually and in combination, on soybean's ability to withstand heat and drought stress during the reproductive stage. Plants grown under nonstress were exposed to long-term heat stress during R1-R8 and short-term drought during R5. The effectiveness of biostimulants was assessed by comparing yield and morphological parameters with an untreated control under drought or heat. BioP increased pod number under drought but substantially reduced pod weight as compared to the untreated control. A combination of BioSa and BioFriendly increased plant height and substantially reduced seed weight compared to the untreated control under heat stress. In contrast, HM-2163, Fertiactyl, Azterknot, and the treated check (standard insecticide and fungicide treatment) showed a marginal increase in seed yields over the untreated control under drought. These findings show some potential of biostimulants in alleviating stress impact on soybeans during the reproductive stage. However, to gain a more comprehensive understanding of their potential benefits, we are evaluating the effectiveness of these biostimulants in field conditions.

Presenter: Durga Purushotham Mahesh Chinthalapudi

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Shankar Ganapathi Shanmugam

Title: Evaluating Cover Crops and N fertilization Effects on Soil Microbiota, Soil Enzyme Activities and Nutrient Cycling in Corn Production Systems

Abstract: In the realm of sustainable agriculture, soil health stands as a critical but often compromised component, necessitating comprehensive scientific investigation. Despite a growing awareness of how some modern agricultural practices can degrade soil quality, there exists a notable gap in our understanding of the specific alterations in the soil microbiome and its consequential impact on C and N cycling and soil quality. Incorporating cover crops (CC) into production systems as a method of agricultural intensification and diversification has emerged as a promising strategy to enhance microbial abundance and foster soil nutrient cycling. To study these dynamics, a three-year study was initiated at two locations (Starkville and Newton) with strip plot design to assess various CC's (ryegrass, balansa, red clover, radish, and CC mixes) and N levels (0 lb. and 100 lb.) effect on soil microbiota and carbon/nitrogen cycling in corn systems. Results revealed significant changes in total carbon, total nitrogen, and soil pH across all cover crop treatments. However, variations among the CC's were not significant after the first year, except for extracellular enzyme activities (β-Glucosidase and β-Glucosaminidase) and soil active carbon (POXC), which exhibited significant differences. Moreover, we observed a linear relationship between β-Glucosidase and POXC ($r^2 = 0.5331$), providing insights into the role of POXC in the carbon cycle. In Starkville, ryegrass plots have higher soil POXC, β-Glucosidase and β-Glucosaminidase, whereas in Newton, both balansa and ryegrass plots had higher values for these parameters. Our findings also unveiled a significant impact of CC and fertilizer level on the alpha and beta diversity of soil microbial communities. Overall, Ryegrass and Balansa exerted a significant influence on soil health and microbial communities by enhancing diversity and richness.

Presenter: Ncomiwe Andile Maphalala

Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Dr. Tseng Te-Ming Paul; Department of Plant and Soil Sciences

Title: Evaluation of Soybean (Glycine max) seeds' inoculation with Rhizobium japonicum and plant growth promoting Rhizobacteria (PGPR) on yield and soil microbial properties: a herbicide carryover perspective

Abstract: Evaluation of Soybean (Glycine max) seeds' inoculation with Rhizobium japonicum and plant growth promoting Rhizobacteria (PGPR) on yield and soil microbial properties: a herbicide carryover perspective Ncomiwe Maphalala1, Alaina Dawkins1, Josiane Argenta1, Sabrina Quevedo Sastre1, Aricia Ritter Correa1, Dante Bergmann Elias1, Te-Ming Tseng11Department of Plant and Soil Sciences, Mississippi State University, Mississippi State, MS 39762 Abstract Corn (Zea mays L.) and soybean [Glycine max (L.) Merr.] are frequently grown in rotation throughout the mid-western United States and Canada. The success of seeding soybean after corn establishment is influenced by the residual nature of the corn herbicides that were applied. Numerous studies have reported on the impact of residual corn herbicides on soybean yield. For example, there is a concern for carry over from fall-applied dicamba and atrazine in soybean. The aim of this study, therefore, is to determine if inoculating soybean seeds with Rhizobia enables the plants to withstand the impact of corn residual herbicides. Thus, the effect, on plant growth, biomass, injury, nodulation, of five rates of corn residual herbicides (1x, 0.75x, 0.50x, 0.25x, 0x) on soybean inoculated with Rhizobium and plant growth-promoting rhizobacteria (PGPR) were investigated under greenhouse conditions. PGPR inoculant Bacillus subtillis and Rhizobium japonicum were used for this study. Soybean seeds were inoculated with Rhizobium singly or in a combination with PGPR. The herbicides under evaluation are Atrazine, Callisto, Lexar and Steadfast. A significant variation of plant growth, injury, nodulation and biomass in response to inoculating or co-inoculating with B.subtillis and B.japonicum, at all atrazine herbicide rates, was observed. Co-inoculation with 0.25X herbicide rate treatment significantly decreased herbicide injury, increased growth, dry biomass, and nodulation. Co-inoculation with B.japonicum and B.subtillis demonstrated a significant increase in plant growth, dry biomass, nodulation and a decrease in herbicide injury. The results show that all treatments with bacteria increased biomass, nodulation and reduced injury compared to treatments with none, however treatments co-inoculated at 0.25x rate, at a scale of 0 (no injury) to 5 (severe), gave a significant reduction in plant injury (0-1 (no injury to slight)).

Key words: residual herbicide, injury, plant growth, rhizobium

Presenter: Bala Subramanyam Sivarathri

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Raju Bheemanahalli Rangappa

Title: Influence of Biostimulants on Soybean Seedling Vigor Traits
Under Low and High Temperatures

Abstract: Seed germination and seedling establishment are often adversely affected by extreme temperatures. The application of biostimulants has been proposed as an effective method to improve uniform germination and overcome the challenge of uneven seed growth. The study aimed to determine the impact of biostimulant-treated seeds on stress tolerance during germination and emergence under various temperatures. Three independent experiments were conducted with nine different treatments, to explore the influence of biostimulants on germination and emergence to different temperatures. Soybean seeds treated with biostimulants were subjected to temperatures of 15 °C, 25 °C, and 35 °C for seven days during germination. The main effect of biostimulants and temperatures were significant for time to 50% germination, radical length, and dry weight. Moreover, preliminary results indicated that the time taken for 90% germination was significantly influenced by both biostimulants and temperatures. In the pouch method, seeds treated with Fertiactyl germinated 8 h earlier than the untreated check, and seeds treated with Fertiactyl+Biofriendly accelerated the time to 90% emergence by 19 hours in the pot method. In the pouch experiment, seeds treated with BioWake increased the seedling vigor index by 14%, while HM-2163 improved it by 6.76% and 17% in the paper towel and pot method, respectively. These findings suggest that some biostimulants positively influence the germination process under extreme temperatures. In addition, the potential influence of biostimulants on growth and development at the early vegetative stage under different temperature conditions will be discussed.

Keywords: Biostimulants, Seed germination, Temperature, and early seedling vigor Index.

Presenter: Michael Althman

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Prof. Dr. Luis Avila; Associate Professor; Department of Plant and Soil Sciences

Title: INFLUENCE OF FLIGHT HEIGHT AND SPRAY QUALITIES ON THE SWATH WIDTH OF A DJI T40 DRONE

Abstract: The objective of this work was to evaluate the effect of flight height spray qualities on swath width of ta DJI T40 drone. The research was carried out in the city of Piraju-SP, Brazil in March 2023. 09 configurations were carried out, varying spray qualities (fine, medium and coarse), flight height (4 , 5 and 6 m), at an application rate of 10L ha. The methodology was based on the ASAE S386.2, 2018 standard, using a nylon string as a droplet collector, on which only water and dye were applied. After application, each string was collected and the four replicates were analyzed on a spectrophotometer equipped with a software, which calculated the Coefficient of Variation (CV%). The process ended with the indication of the best swatch width according to the uniformity indicated by the CV for the back-to-back (back-to-back) and race-track patterns. The obtained swath widths ranged from 7 to 10 m, with a coefficient of variation within the acceptable range of up to 20%. It was possible to identify that the droplet spectrum and flight height were determining factors in defining swatch width, once greater heights and finer droplets increase the swath widths.

Presenter: Raveendra Chandavarapu

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Raju Bheemanahalli; Dept. of Plant and Soil Sciences

Title: Marker-assisted introgression of OsPSTOL1 gene for low soil phosphorus tolerance in rice

Abstract: Growing rice on poor soils without totally depending on phosphorus (P) fertilizer could soon become a reality. About 60 percent of rain-fed lowland rice is already cultivated in P-deficient soil. Therefore, the development of rice varieties with high productivity under low P conditions warrants the use of a forward genetic approach to improve yield in rice-dependent countries. Early molecular mapping allowed the identification of major genomic regions for phosphorus uptake (Pup1) and further fine mapping allowed identification of phosphorus-starvation tolerance 1 (PSTOL1) gene with in the Pup1 region. The goal of this research was to improve rice's ability to tolerate P deficiency by introducing the OsPSTOL1 gene through marker-assisted and phenotypic selection. Parental lines (CO 51, P-sensitive and high-yielding female, and ISM Pup1, P-tolerant male) were crossed and true F1 plants were identified using functional markers associated with OsPSTOL1 (K29-2, K46-1, K46-2). The F1 plants were self-pollinated to produce the F2 generation, where homozygous plants with the OsPSTOL1 gene were identified. These plants were self-pollinated until the F6 generation, where 22 homozygous improved lines were selected based on both molecular and phenotypic assays. These lines were screened under P-deficient conditions. Among all lines, one line (#2-21-2) produced the highest yield (14.8 g) compared to both parents (4.5 g in CO 51 and 8.4g in ISM Pup1). This research highlights the importance of using both marker-assisted and phenotypic selection to develop crops that are adapted to climate change.

Keywords: Rice; Marker-assisted selection; Phenotypic screening; P deficiency tolerance

Presenter: Mohan Kumar Bista

Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Raju Bheemanhali Rangappa; Plant and Soil Sciences

Title: Phenotyping of Cotton Breeding Lines for Drought Tolerance

Abstract: Cotton (Gossypium spp.) is an economically important crop cultivated worldwide for its textile fiber. Although cotton is grown under upland conditions, it is vulnerable to drought stress, especially around the reproductive stage. Suboptimal rainfall and prolonged droughts during sensitive growth stages are increasingly common in cotton-growing regions of the US Midsouth. Therefore, developing drought-tolerant cultivars has become a priority, and to achieve this, it is essential to understand the physiological and yield responses of breeding lines to drought stress. This study investigated the physiology and yield potential responses of twelve cotton breeding lines to two irrigation treatments: 100% irrigation as a control and 50% as drought during the reproductive stage. Drought-stressed plants significantly had lower stomatal conductance by 83%, transpiration by 73%, and the quantum efficiency of photosystem II (PhiPS2) by 12% compared to the control. Although cotton boll temperature did not show a significant increase between treatments, the canopy (2.6 °C) and leaf temperature (1.7°C) were significantly higher ($p < 0.01$) in drought-stressed plants than in the control. This finding highlights differential transpiration between the reproductive and vegetative parts of cotton under drought. Impaired physiological parameters significantly reduced boll number (57%) and cotton seed yield (59%). Based on the stress tolerance index, Phytogen PSC 355 and Acala Ultima demonstrated the highest and lowest tolerance to drought stress, respectively. These results suggest that genetic variability in cotton breeding lines can be exploited for developing drought-tolerant cotton for rainfed environments and for genomic studies.

Presenter: Apphia Santy

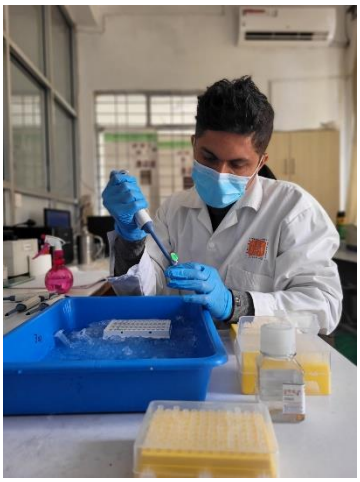
Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Dr. Guihong Bi

Title: RASPBERRY CULTIVAR EVALUATION TRIAL IN MISSISSIPPI

Abstract: The Raspberry Cultivar Evaluation Trial conducted at the Mississippi State University North Farm in Starkville aims to evaluate the adaptability and performance of twenty-six raspberry cultivars in Mississippi, considering factors such as heat and cold tolerance, pest and disease resistance, berry yield, and fruit quality. This study a randomized complete block design with a 2x10 factorial arrangement, incorporating two fertilizer types (conventional and organic) and each treatment was replicated five times, and within each replication. Environmental conditions, including temperature, humidity, were monitored throughout the study. Key data collection points encompassed plant growth and performance, phenological observations, and berry harvests. This study addresses the demand for raspberries in Mississippi, particularly focusing on identifying cultivars suitable for local production and extending the fruiting season. These findings offer valuable insights for growers seeking to maximize raspberry yield and fruit quality in Mississippi's unique growing conditions.



Presenter: Sujan Poudel

Level of Study: Master's

Category: Agriculture and Life Sciences

Advisor: Dr. Raju Bheemanahalli Rangappa (Assistant Research Professor, Department of Plant and Soil Sciences)

Title: Response of Cowpea to Drought Stress during Early Growth and Development

Abstract: Cowpea (Vigna unguiculata), also known as black-eyed pea, is a widely cultivated legume crop that can adapt to various environmental conditions. Drought stress is a major factor that affects crop productivity worldwide. However, like many other crops, cowpea is vulnerable to drought stress during the vegetative stage. Drought during this stage limits water uptake and disrupts various physiological processes associated with growth and development. Although cowpeas are relatively tolerant to drought compared to other crops, recovery mechanisms employed by cowpeas following drought stress are overlooked. To address this knowledge gap, this study utilized a pot-culture facility to assess the recovery response of the physiological traits of cowpeas. Two cowpea genotypes, UCR 369 and EpicSelect.4, were exposed to different levels of soil moisture content at the V2 growth stage. The moisture levels were maintained at either 100% (control) or 50% replacement of evapotranspiration (drought) for 14 days using a semi-automated soil sensor-based irrigation system. Thereafter, drought plants were rehydrated to facilitate recovery. Drought stress treatment significantly affected all measured traits. ANOVA showed significant inhibitory effects of drought stress on all studied traits. Drought-stressed plants reduced stomatal conductance by 97% to reduce water loss via transpiration, which hampered photosynthesis (88%) and increased canopy temperature by 2.8 °C compared to the control. Under drought, the reduction in plant height and node number was highest in genotype EpicSelect.4 compared to control. The gas exchange traits of cowpeas showed a remarkable recovery response following drought stress. EpicSelect.4 seems to have inherent mechanisms that allow it to adapt to favorable conditions quicker than UCR 369. Further exploring the underlying mechanisms associated with recovery response can help the development of drought-tolerant cowpea varieties.

Presenter: Oscar D. Ramirez Perez

Level of Study: PhD

Category: Education, Arts and Sciences, and Business

Advisor: Julia S. Soares, Assistant Professor,
Department of Psychology

Title: Not so fast! Investigating the effects of increasing playback speed of video lectures on learning

Abstract: Asynchronous video lecture is a common tool used for distance learning. Many platforms include functionality to increase playback speed. Previous work has suggested limited impairments associated with speeding lectures less than 2.5x speed (Murphy et al., 2022; Wilson et al., 2018). Across three experiments, we investigated how manipulating playback speed affects learning from video lectures.

Experiment 1 compared test performance for educational videos played at normal speed (1x) to videos played at 2x speed within-subjects. We found that performance on a fill-in-the-blank memory test was impaired in the 2x condition as compared to the 1x condition, $t(49) = 3.39$, $p < .01$, $d = 0.48$, CId [0.18, 0.77].

In Experiment 2, we added a 1.5x condition to playback speed, adding a third video from the same creator. We also used both fill-in-the-blank questions and multiple-choice questions to test whether different question types are more sensitive to increases to playback speed, resulting in a 2 (test type) x 3 (playback speed) fully within-subjects design. We found a main effect of speed, such that performance was worse at higher speeds, $F(2, 358) = 22.61$, $p < .01$. There was no evidence that playback speed interacted with test type, $F(2, 358) = 1.21$, $p < .30$.

In Experiment 3, we assigned half the participants to take notes, and tested everyone with multiple-choice questions to examine the possibility that note-taking could influence the effects of speed by increasing participants' cognitive load. As in Experiments 1 and 2, we found that as speed increased, performance decreased $F(2, 736) = 34.96$, $p < .01$. Participants in the notes condition also scored higher than those in the no-notes condition $F(1, 363) = 10.08$, $p < .01$. Critically, we found an interaction such that speed-related impairments were larger in the notetaking participants, $F(2, 726) = 4.36$, $p = .01$, consistent with a cognitive load account of the speed impairment. Indeed, notetaking participants showed an impairment on the test even at 1.5x playback speed , $t(166) = 4.08$, $p < .01$, $d = 0.32$, CId [0.16, 0.47] relative to the 1x speed control. These experiments suggest that speed-related learning impairments can arise at lower speeds than previously thought.

Presenter: Patricia Marie Cordero-Irizarry

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Donna Peterson, Extension Specialist, School of Human Sciences

Title: Digital Natives or Novices? Exploring Online Learning Readiness in Undergraduate Students

Abstract: Effective communication between instructors and students is a determining factor for student success. However, communicating with students at a distance requires more thought and preparation than in traditional settings. There is a gap between students' and instructors' respective communication readiness for online learning, especially in higher education, which leads to poor student engagement and academic achievement. Therefore, the unprecedented development in online learning has made it necessary to develop measures to assess students' preparation for this changing learning environment. An emerging tool for assessing students' readiness for online learning is the Online Learning Readiness Scale (OLRS). Online learning readiness involves the capacity to interact with peers and technical proficiency in word processing, graphic design, and learning management systems (LMS) software. Evaluating the degree of student readiness for online learning can help instructors create better online courses and direct students toward rewarding and successful online learning experiences. This study evaluated students' online learning readiness through the OLRS to ascertain whether students are ready for online learning and whether communication between the instructor and the students is effective. It included statements regarding computer/internet self-efficacy, self-directed learning, learner control, motivation for learning, and online communication self-efficacy. The instrument was adapted to an online Qualtrics survey and distributed to undergraduate students who enrolled in a professional presentations course during the Winter 2022, Summer 2023, and Fall 2023 semesters. Frequencies, median, mode, and range analysis were conducted in SPSS. Preliminary results suggest that the OLRS is an effective diagnostic tool to find areas for improvement in the design and offering of online courses. Undergraduate students have different levels of readiness and technical proficiencies for online learning. This suggests that educators should exhibit flexibility given that online learning is often self-paced, and thus may require more attention and time for students. The study highlights the potential of diagnostic tools to enable the customization of online courses that are tailored to students' needs and preparedness levels which will ultimately lead to their academic success.

Presenter: Samrat Sikdar

Level of Study: PhD

Category: Agriculture and Life Sciences

Advisor: Dr. Nesma Osman

Title: Illustrating the Notion of "Farm Innovation Brokers" in Pluralistic Extension Regime: A Conceptual Analysis

Abstract: Privatization has become quite prominent in the domain of extension worldwide and that phenomenon has transformed the extension more pluralistic as well as demand driven. It is hardly possible to meet all the demands of the current farm sector as the privatized extension system is not yet well-equipped. There is a felt need of shifting the production-technical focus of agricultural extension to supporting the entrepreneurship of farmers focusing on 'profit, people, and planet.' In the context of such 'Triple P entrepreneurial farming,' intermediate model, involving an intermediary agency acting as a broker between farms and generic business support providers is the most suitable. This is because traditional agricultural extension services would not be suited to provide generic business support to farms, and suppliers of non-agricultural support services and farmers would be too unfamiliar in dealing with one another. Thus, the purpose of this review-based work is introducing the concept of innovation brokers and their functions in the Agri-innovation system. Innovation brokers are persons or organizations that, from a relatively impartial third-party position, purposefully catalyze innovation through bringing together actors and facilitating their interaction. Innovation brokering expands the role of agricultural extension from that of a one-to-one intermediary between research and farmers to that of an intermediary that creates and facilitates many-to-many relationships. Innovation brokering represents the institutionalization of the facilitation role, with a broad systemic, multi-actor, innovation systems perspective. Innovation brokers act as "systemic intermediaries" in innovation systems, forging many-to-many relationships. A range of innovation brokers are placed in the pluralistic extension system like Farmers groups, Livestock input dealers, independent service providers, R&D organizations, public service providers, private service providers including the not-for-profit service providers etc. who influence the farmers' decision making, either implicitly or explicitly. There are few major categories of farm innovation brokers based on the typology which includes Innovation consultants, aimed at individual farmers and small and medium enterprises (SMEs) in the agri-food sector, Innovation consultants aimed at collectives of farmers and agri-food SMEs, Peer network brokers, Systemic intermediaries for the support of innovation at higher system level, Internet-based portals, platforms, and databases etc.

Presenter: Ridwan T. Ayinla

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Prof. Hassan El-Barbary (Department of Sustainable Bioproduct)

Title: Biomass-derived electrode and electrolyte for green supercapacitors

Abstract: Supercapacitors, known for their high-power density and rapid charge-discharge capabilities hold immense promise for addressing the growing demand for sustainable energy storage solutions. This research presents a sustainable approach to the development of green supercapacitors by utilizing biomass-derived materials for both electrodes and electrolytes. The sustainable nature of these materials aligns with the global drive towards green energy technologies and the circular economy. Herein, we developed green supercapacitors by utilizing biomass-derived materials for both electrodes and electrolytes. Activated carbon prepared from pine bark using acid (H_3PO_4), base (K_2CO_3), and salt ($ZnCl_2$) as activation agents at different activation temperatures (600, 800, and 1000 ℃) were used as the active material of the electrodes. Cellulose nanofiber was also derived from wood pulp and crosslinked with mobile Cu^{2+} ions as the electrolyte. The surface area and porosity of the prepared activated carbon showed an increasing trend with increasing activation temperature for all activation agents. Real supercapacitors were fabricated with excellent energy and power densities. This research underscores the importance of sustainable and environmentally friendly alternatives in the transition towards a greener and cleaner energy future.

Presenter: Suman Pradhan

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Mostafa Mohammadabadi

Title: Enhancing Rolling Shear Performance of Southern Yellow Pine Cross-Laminated Timber (CLT) through Densification.

Abstract: This research explores the enhancement of rolling shear performance in cross-laminated timber (CLT) by densifying the transverse mid-layers. The study utilized Loblolly pine (Pinus taeda L.), a species categorized as Southern Yellow Pine (SYP), to create CLT rolling shear specimens. By applying a thermomechanical densification technique, the lumber underwent densification to varying compression ratio (16.67%, 33.33%, and 50.00%) after softening through boiling water immersion for 10 minutes. Subsequently, hot-pressing at 140°C was employed to achieve the target thickness reduction from the initial thickness, yielding lumber with an average density of 641.23 kg/m3. In order to distinguish the influence of enhanced density on shear performance from that of aspect ratio, CLT rolling shear specimens were fabricated using non-densified lumbers with identical aspect ratios to the densified counterparts. The evaluation of CLT specimens' rolling shear performance was conducted through modified planar shear testing. The results indicated a notable 108% increase in rolling shear strength with a 50% compression ratio of the transverse layer. Furthermore, a clear linear correlation was observed between the percentage increase in rolling shear strength and the compression ratio. While an increased aspect ratio positively impacted rolling shear strength, the study demonstrated that specimens with densified transverse layers have higher performance than the non-densified specimens with the same aspect ratio.

Presenter: Mercy Ogunruku

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Tamara Franca; Sustainable Bioproducts

Title: Evaluating Selected Properties of Underutilized Hardwood Species for Fabrication of Cross-Laminated Timber Industrial Mats

Abstract: There is a higher demand for softwood than hardwood due to the fact that the largest wood-consuming industry (construction) in the US uses mostly softwood, meanwhile, to meet the demand for softwood, there is an increase in the import of softwood by the year, whereas, hardwood whose use has been for non-structural applications such as furniture, interior designs, decking, flooring is more available in the US forest than softwood. While some hardwood species are being used for the above-listed purposes some are underutilized and undervalued. The advent of CLT, which has found its way into construction and other industries like timber industrial mat manufacturing has also increased the ever-growing demand for softwood. This research evaluated the mechanical and physical properties of three underutilized hardwood species (Yellow poplar, sweetgum, and red oak) for the manufacture of CLT industrial mats. The variables evaluated in this study include density, Modulus of Rupture (MOR), Modulus of Elasticity (MOE), the strength relationship between grades, and the physical and mechanical properties. A total of 262 boards of red oak were tested, 393 boards of sweetgum, and 321 boards of yellow poplar were tested for this study. Samples were all classified into grades according to NELMA (2013) grading standards per species. The study shows that the red oak exhibited higher density than southern yellow pine, the wood commonly used in CLT manufacturing. Additionally, all tested species had an average MOE greater than the CLT lumber requirement, showing promising strength. The findings also revealed a clear correlation between MOE and MOR and implied visual grading's effectiveness in assessing lumber strength. The study was therefore able to ascertain the viability of the three underutilized hardwoods tested to have the physical and mechanical properties required for the fabrication of CLT. It will be an excellent substitute for the use of softwood in the manufacture of CLT meant for the fabrication of Industrial mats.

Presenter: Richard O. Omotayo

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Fred Franca

Title: Nondestructive evaluation of stiffness and strength of Cross Laminated Timber (CLT) made from different species - southern yellow pine, red oak, yellow poplar and sweet gum

Abstract: Cross Laminated Timber (CLT), a type of engineered wood product, made by gluing layers of sawn lumbers together in a perpendicular manner is becoming widespread in the construction sector especially for high rise buildings. The increased demand for CLT is due to need for sustainable construction. To effectively utilize the numerous benefits of this modern building material, there is need to ascertain its strength properties without affecting its serviceability which in turn conserves its source (trees). The objectives of this study were thus to evaluate the mechanical properties of Cross Laminated Timber (CLT) from different species using nondestructive testing (NDT) technique and to compare the mechanical properties of hardwood and softwood CLTs. A total of 1636 pieces of boards obtained from species of red oak (RO), yellow poplar (YP) and sweet gum (SG) were used to manufacture 32 strips each, of CLT totaling 96 strips to a size of 3.5” thick x 6” wide x 7ft long. 30 strips of CLT industrially manufactured from southern yellow pine (SYP) species were also tested to serve as control. After the NDT evaluation, all specimens were destructively tested. There was high correlation between dynamic modulus of elasticity (dMOE) from NDT and static MOE. The average values of dMOE and MOE for SYP, RO, YP and SG respectively were: 1477115 psi and 1364247 psi; 1871950 psi and 1919991 psi; 1395045 psi and 1568657 psi; 1488425 psi and 1496374 psi. The MOR of SYP, RO, YP and SG were 5251 psi, 7653 psi, 6530 psi and 5239 psi respectively. This indicates that NDT can be a better alternative for the determination of strength properties of CLT which is essential in grading and quality control procedures. In addition, SYP CLT was observed to have the highest strength-to-weight ratio despite performing less than CLT samples from red oak species. This justifies SYP as a better choice. However more studies should still be done in ascertaining the reliability of NDT technique for CLT.

Presenter: Shuaib Mubarak

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Yunsang Kim, Ph.D. Assistant Professor, Department of Sustainable Bioproducts

Title: Wood Flame Retardancy Enhancement through Phytic Acid Encapsulation in Water-in-Oil Pickering Emulsion Stabilized by Cellulose Nanofiber.

Abstract: Wood is an inherently combustible material that has a porous structure, rendering it suitable for many applications such as building, furniture production, and interior decorating. However, despite its versatility and natural renewability, the combustibility of wood introduces certain safety hazards. As a result, there has been a growing focus on environmentally safe flame retardants. This study focuses on the encapsulation of phytic acid (PA), a flame retardant derived from natural sources that is soluble in water. The encapsulation process involves the use of a water-in-oil (W/O) pickering emulsion system, which is stabilized by TEMPO-treated cellulose nanofiber. In order to accomplish this objective, we first generated a series of water-in-oil (W/O) Pickering emulsions by using oleylamine and poly(acrylic acid) (PAA) as surfactants for the oil and aqueous phases, respectively. This surfactant combination aided the hydrophobic alteration of TCNF. The aqueous phase consisted of different concentrations (ranging from 0.05 wt% to 0.3 wt%) of TCNF, along with 10% PAA based on the relative dry mass of TCNF. The oil phase consisted of a toluene solution containing 2.5wt% of oleylamine. The water and oil combination underwent high-power ultrasonication in order to generate water-in-oil (W/O) emulsions. The use of confocal laser scanning microscopy and optical microscopy was applied in order to validate the creation of water-in-oil (W/O) emulsions and assess their size. The results indicated a decrease in the diameter of the emulsions as the concentration of thermally conductive nanofibers (TCNF) increased. In the present study, the 0.3wt% TCNF sample was used to incorporate 20wt% of PA into the internal aqueous phase, resulting in the production of encapsulated phytic acid.

Presenter: Shamaria M. Mosley

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Associate Professor, Dr. Miller, TEAL

Title: Untraining Implicit Biases

Abstract: Implicit biases held by educators within the education system pose unfavorable effects on their

teaching practices to a growing diverse student body population. Research shows these acts may

include a lack of counselor referrals that inadvertently results in heightened disciplinary referrals

for students of color. Recent studies have recognized the urgency of this matter and have taken action to combat this issue. By synthesizing twenty research articles, this research in progress aims to uncover the causes of implicit bias, its impact on education, and previous intervention attempts. This study combines seven empirical studies involving Black children, educators' emotional states, and awareness of unspoken skin tone biases within the educational system. Additionally, six mixed method studies reveal educational differences regarding students of color compared to White children, as well as contradictions in teachers' intentions and disciplinary measures. This research in progress reviews seven cross-sectional studies that incorporates a variety of intervention methods among predominantly White instructors. Furthermore, this research in progress reviews a longitudinal study conducted in China that investigates whether implicit biases can be reduced. Although there are noteworthy intervention attempts, longitudinal research in this field of study is lacking. Therefore, this research in progress is an attempt to reveal what an effective long-term intervention of untraining implicit biases entails. The findings will be useful for preparing the groundwork for the development of possible effective strategies to reduce negative implicit biases indefinitely.

Keywords: implicit biases, skin-tone biases, education system, disciplinary referrals

Presenter: Valencia Epps

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Associate Professor, Dr. Miller, TEAL

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Keywords: implicit biases, skin-tone biases, education system, disciplinary referrals

Presenter: Krista Ruppert

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Scott Rush, Associate Professor, Department of Wildlife, Fisheries, and Aquaculture

Title: Assessment of the Genetic Diversity and Relatedness of Gopher Frogs (Rana [Lithobates] capito) on the Conecuh National Forest, Covington County, AL

Abstract: Gopher frogs (Rana [Lithobates] capito) are pond-breeding amphibians native to longleaf pine forests in Alabama, Florida, Georgia, North Carolina, and South Carolina, where they are state-protected across their range. In Alabama, gopher frogs are known to consistently breed only in two ponds, both located on the Conecuh National Forest. Life history traits of amphibians, including gopher frogs, may influence the genetic connectivity of populations. In particular, breeding site fidelity and variable reproductive success across years can make amphibian populations vulnerable to a loss of genetic diversity. Additionally, the small populations in Alabama are geographically isolated from other known gopher frog populations, which may increase the risk of genetic drift. Through this project, we aim to assess the genetic diversity of gopher frogs in the Conecuh National Forest via microsatellite genotyping. Metrics of genetic diversity, relatedness, and inbreeding will be determined and compared to gopher frog populations in Florida (where connectivity is comparably high) and North Carolina (where connectivity is reduced), as well as the dusky gopher frog (Rana [Lithobates] sevosa) population in Mississippi (where genetic drift and a population bottleneck have been previously described). Results from this project will identify where more intensive management strategies to enhance the genetic structure of this species within Alabama can be effective in supporting the conservation of gopher frogs and other species of concern.

Presenter: Darren Shoemaker

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Leandro Miranda

Title: Challenges evaluating reservoir fish habitats in a changing climate

Abstract: Keywords: climate, habitat, fish

Reservoir habitat degradation due to aging is well documented, and climate change may accelerate this decline. However, projection models suggest climate will impact distinct geographic areas at different intensities. For instance, precipitation is expected to increase overall but lessen in continental interiors. This uncertainty necessitates scientists and stakeholders to identify how habitats are likely to respond to climate change. Conservation of reservoir habitats is critical as they provide many ecological and societal functions, including water supply, fish conservation, and recreation.

We are developing a vulnerability index for reservoirs across the United States to better prepare managers for climate change during the 21st century. Our goal is to use the results of this study to create an index of vulnerability for the United States which shows how reservoir conditions are likely to be affected by climate. This will be a valuable tool for fish and reservoir managers to determine how to best allocate limited resources when making conservation decisions.

A database which includes relevant habitat characteristics such as reservoir size, depth, catchment, and land use for 3,825 reservoirs across the United States was obtained from the Reservoir Fish Habitat Partnership. Estimates for 19 historic (1970-2000) and future (2081-2100) bioclimatic indicators were obtained for each of the reservoirs from the climate database WorldClim at a 2.5 minute spatial resolution (~4.5 km at the equator). These indicators include various descriptors of temperature and precipitation commonly applied in climate change investigations and are likely to influence fish habitats.

We are applying a variety of modeling frameworks to determine which reservoir habitat characteristics have historically been influenced by climate change. We will then determine the differences between the historic and future climate conditions at each reservoir to estimate the intensity of the effects of climate change. From these, we can predict which reservoirs are likely to be impacted by climate change.

However, we have encountered many sources of uncertainty during this research. Here, we present some of the challenges we have faced, solutions we have attempted, and solicit feedback on our efforts thus far.

Presenter: Ashmita Poudel

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Andrew J. Kouba

Title: Developing Near Infrared Spectroscopy (NIRS) Sampling Methodology for Modeling Species Discrimination in Live Catfish (Ictalurus sp.) for Aquaculture

Abstract: Near infrared spectroscopy (NIRS) has been used in various applications such as food science, pharmaceuticals, agriculture, wildlife sciences, conservation, and fisheries. In fisheries it is extensively used for ageing and species differentiation through otolith. NIRS is also utilized to study various aspects of fish or aquatic science such as evaluating the quality, fat, moisture and protein content, freshness of fish fillets, quality control, protein and energy digestibility, and ingredients in feed. NIRS is rapid, non-invasive, and inexpensive tool and has been used in several live animals to discriminate the biological sex, species, physiology, disease of animals. However, the feasibility of the NIRS to study the live fish for species distinction, biological sex, reproductive maturity is yet to be determined. The preliminary study was conducted to determine if live fish can be used for spectroscopic analysis. The main objective was to ascertain and develop an attainable model to discriminate the species of the catfish which can only be differentiated through molecular technique. Channel and blue catfish ~750-800 gm was used for this study. Spectra from the 20 fish of each species were collected in three different methods: without anesthesia, with anesthesia (MS-222, 100mg/ml immersion) and gavage technique (2gm MS-222, 4gm NaHCO3/L). Head, region above the swim bladder around the lateral line and vent were used. Linear discriminant analysis (PCA-LDA) with the use of the wavelength from 700-1300 nm gave the better prediction model compared to the full NIR range (700-2500nm). Based on the prediction accuracy, head had a better outcome in all the different methods than other two regions. Spectra from the head in gavage method predicted greater than 91% accuracy for differentiation of blue and channel catfish.

Presenter: Jing Huang

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Fernando Y. Yamamoto PhD Assistant Research Professor Thad Cochran

Title: Evaluating the effects of autochthonous bacteria Lactococcus lactis MA5 as feed supplement for hybrid catfish (Ictalurus punctatus × I. furcatus)

Abstract: The application of probiotics as diet supplements on cultured animals has been regarded as a crucial strategy to improve fish health and production yield for fish farmers. Probiotic supplementation can improve growth performance, enhance immune responses, and inhibit the proliferation of pathogenic bacteria. This inhibition happens via nutrient and site competition or by altering the intestinal pH. Due to their rapid development, catfish production in the United States has become the primary farmed fish. To support hybrid catfish production in the U.S., a potential autochthonous bacteria, Lactococcus lactis MA5, was isolated from the digesta of outperforming hybrid catfish reared in earthen ponds. In this study, a 56-day feeding trial was conducted, testing 104, 106, and 108 CFU of MA5 per gram of feed. The commercial feed without supplementation served as a control. In total, 560 juvenile hybrid catfish (~16.1±0.1 g initial weight) were randomly assigned to four dietary treatments with seven replicate tanks. Fish were cultured in an indoor flow-through system (0.5 L/min), and twenty fish were stocked per tank. At the end of the study, growth performance parameters, serum, intestine, and immune-related organs were collected to evaluate the functional properties of MA5 in the diets of hybrid catfish. At the end of the feeding trial, the dietary treatments did not affect the growth performance. Interestingly, the number of goblet cells in the intestine significantly increased when catfish were offered 104 and 108 CFU of MA5/g, compared to the control. In addition, tunica muscularis thickness also increased when compared to the control group. From the serum samples, the antioxidant enzyme superoxide dismutase (SOD), and the immune lytic enzyme lysozyme increased in a dose-dependent manner. Immune-related genes (IL-1β, IL-6, IL-8, IL-10, TNF-α) expression levels from the anterior intestine and head kidney were also assessed in this study. Generally, the highest dose (108 CFU/g) significantly increased IL-1β and IL-6 cytokine expression in the head kidney when compared to the control group. Acute phase response cytokine TNF-α in the head-kidney decreased when fish were offered the probiotics. Zonula occludens type I and II expression levels in mid-gut are significantly decreased when fish were offered diets supplemented with the highest probiotic dose. After the feeding trial, a bacterial challenge test was carried out; fish received Aeromonas hydrophila via intraperitoneal injection with a 5.3 × 106 CFU/g body mass. After 7 days post-challenge, results indicated that after receiving the lowest probiotic dosage (104 CFU/g), hybrid catfish fish had a significant increase in survival rate (72.45%, p=0.001) when compared to the control group (49.5%). In conclusion, the supplementation of L. lactis MA5 has benefits on increasing goblet cells in the intestine, promoting SOD and lysozyme activities, and significantly augmenting the resistance against A. hydrophila after infection.

Presenter: Madalyn Stoecker

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Kristine O. Evans, Wildlife Fisheries and Aquaculture

Title: Forest Structure and Edge Effects on Bee Functional Diversity in Working Pine Forests

Abstract: Private, working forests provide unique opportunities for biodiversity research and management. Even-aged management often creates a heterogeneous mosaic of forest stands in southeastern loblolly pine (Pinus taeda) landscapes, with each stand containing structural and compositional characteristics that support different plant and bee communities. Interspersion of different structural conditions, combined with roads separating adjacent stands, leads to prevalence of edges across much of the landscape, which may have varying effects on species. We evaluated how landscape heterogeneity and presence of edge influences functional diversity in wild bee (Hymenoptera: Apoidea: Anthophila) communities during the summers of 2022 and 2023. We collected bee specimens and vegetation data on 36 stands within two commercially managed loblolly pine forest landscapes (east Mississippi and west Alabama). We conducted sampling at point locations within each stand at 0, 50, and 100m perpendicular distances from adjacent roads in early-successional (0-3 years), pre-thinned (4-15 years), and thinned mid-rotation (15-21 years old) stands. Bees and plants were identified to species and genus, respectively, and categorized according to life history traits to calculate functional metrics such as richness, evenness, and divergence. Functional characteristics include active season, body size, and nesting location for bees and blooming period, flower shape, and shade tolerance for plants. Preliminary functional diversity models show communities have strong correlation with forest location, followed by stand stage. Early successional stands had the highest bee abundance and Shannon diversity scores in both forests. Our findings will help forest managers target biodiversity goals within sustainable forest management plans.

Presenter: Hafez Ahmad

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Leandro E. Miranda(Professor, USGS Cooperative Fish and Wildlife Research Unit and Wildlife, Fisheries, and Aquaculture)

Title: Hydrologic connectivity between lakes and rivers in the Lower Mississippi Alluvial Valley

Abstract: This research investigated hydrologic connectivity, the intricate network of water pathways linking aquatic habitats, and its implications for biodiversity exchange in floodplains. Chapter 1 provides an exhaustive literature review encompassing factors influencing hydrologic connectivity, assessment approaches, scales, challenges, and management tools. Existing research often focuses on single scales and short-term periods, revealing a need for comprehensive multi-scale and extended temporal analyses. The absence of standardized definitions and methodologies in this field is also considered. Chapter 2 presents an innovative approach quantifying eight key connectivity metrics using remote sensing and GIS within the Lower Mississippi Alluvial Valley (LMAV). This adaptable method assesses connectivity between oxbow lakes and varying stream sizes, revealing spatial variability within the LMAV and enhancing our understanding of connectivity dynamics while ensuring portability. This research is crucial for effective ecosystem management and targeted conservation efforts, particularly regarding invasive species like the bigheaded carp (Hypophthalmichthys spp.).

Presenter: Matthew Scott

Level of Study: Master's

Category: Forest Resources and Veterinary Medicine

Advisor: Michael Sandel Professor of Wildlife fisheries Aquaculture

Title: Microbiomics of Amazonian Fishes

Abstract: The Amazon Rainforest is recognized as one of the most biodiverse ecosystems on Earth, particularly when considering macroorganisms (animals, higher plants, and fungi). Relatively speaking, little attention has been paid to the microbiological diversity within this ecosystem, or to the interactions between macro and microbiological communities. Toward this end, we characterized the role of habitat parameters on the gut microbiome of freshwater fishes in three primary watersheds in French Guiana. We conducted seasonal field expeditions in the Approuague, Sinnamary, and Mana River Basins. We collected small stream fishes in the headwaters, middle tributaries, and coastal lowlands. Specimens were preserved in 95% ethanol and gut tissue was extracted using commercial DNA extraction kits. We used traditional 16S rRNA metabarcoding to determine the microbial composition in the gut. We calculated measures of microbial diversity and conducted multivariate analyses to compare microbiome composition across species, seasons, microhabitats and macrohabitats. This was done for six species across fourteen fish genera at nine sites. Preliminary results indicate that Characiformes have more diverse microbiomes than Acanthomorpha (cichlids, Poecilia, Rivulus, etc.), on average. Acanthomorpha microbiomes are more often dominated by Betaproteobacteria, whereas Characiformes are more often dominated by Alphaproteobacteria and Gammaproteobacteria. This may represent conserved regulation of the host gut microbiome within respective fish taxa. Results of this work provide novel insights into the role of local freshwater fishes in shaping environmental microbial communities in tropical floodplain forests. These data can also be used as a tool to detect the bacteria responsible for neglected tropical diseases (NTDs), potentially including zoonotic pathogens.

Presenter: Emma Schultz

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Ray Iglay (Wildlife, Fisheries and Aquaculture)

Title: On the Move: How Animal Movements During Drone Surveys Influence Count Error

Abstract: Remote sensing for monitoring animal populations has greatly expanded during the last decade. Drones (i.e., Unoccupied Aircraft Systems) provide a cost- and time-efficient option to survey animals among various landscapes and sampling conditions. However, drone surveys may also introduce error, especially when monitoring mobile animals. Using an agent-based model simulation approach, we evaluated the sampling error associated with counting a single animal among six drone flight patterns, three animal movement strategies, and five animal speeds. Flight patterns represented increasing spatial independence from a lawnmower pattern with image overlap to systematic point counts. Simulation results indicated flight pattern was the most important variable influencing count, followed by animal movement strategy, then animal speed. A lawnmower pattern with 0% image overlap resulted in the most accurate count of a solitary animal on a landscape regardless of the animal's movement pattern and speed. Image overlap flight patterns were more likely to produce multiple counts even when accounting for image mosaicking. If animals are moving, count accuracy was best for animals moving with directional persistence. Based on our simulations, we recommend using drone surveys with a lawnmower pattern with 0% image overlap and timing surveys in relation to animal life history timeframes where movement is minimized (e.g., during nesting) or directional (e.g., within migration corridors) to minimize error and improve drone efficacy for animal surveys. This work highlights the importance of understanding the implications of animal movements on population estimates generated from drone-based surveys, which is broadly applicable among animal species and ecosystems.

Presenter: David L. Pounders

Level of Study: Master's

Category: Education, Arts and Sciences, and Business

Advisor: Michael W. Sandel; Wildlife, Fisheries, and Aquaculture

Title: Population genomic structure of the Everglades Pygmy Sunfish yields evidence of vicariant speciation

Abstract: The Everglades Pygmy Sunfish (Elassoma evergladei) ranks among the smallest and least-understood freshwater fishes with a wide distribution in North America. This species has the potential to have pockets of overlooked populations with high levels of genetic variation. To date, no study has systematically assessed morphological or molecular genetic variation across the species geographic range, which includes minor coastal watersheds from Alabama to North Carolina. Sampling was completed so nearly all populations can be analyzed, including different ecoregions within the coastal plain. We used mitochondrial cytochrome b (CYTB) DNA sequences and double-digest Restriction-site Associated DNA sequencing (ddRADseq) to characterize genomic variation among 100 populations across the species range. We also used trypsin-cleared and stained specimens to examine osteological variation among populations. Our analyses reveal strong population-genetic structure across even locally isolated watersheds, and yield evidence for vicariant speciation across the northern Gulf Coastal Plain. This work highlights the need for continued investigation of intraspecific genetic variation among North American freshwater fishes. Results of this work will aid in the development of conservation plans for this wetland adapted species with strong population genetic structure, which are rapidly threatened by anthropogenic habitat disturbance.

Presenter: Krista Ruppert

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Scott Rush, Associate Professor, Department of Wildlife, Fisheries, and Aquaculture

Title: Upland Microhabitat Use by Gopher Frogs (Rana [Lithobates] capito) on the Conecuh National Forest

Abstract: Gopher frogs (Rana [Lithobates] capito) are pond-breeding amphibians native to longleaf pine forests of the southeastern United States. In Alabama, gopher frogs are a protected species known to consistently breed in two ponds, both located on the Conecuh National Forest. Outside of the breeding season, gopher frogs can be found in and around burrows in sandy uplands, such as stump holes, small mammal burrows, and gopher tortoise burrows. As longleaf savanna specialists, gopher frogs are thought to rely on fire-maintained areas with open canopy, wiregrass presence, and complex ground cover; however, information on specific upland microhabitat use of gopher frogs is scant. As gopher frogs spend most of their lives in upland areas, understanding how gopher frogs use these uplands, and what features they rely on, are essential to their conservation. Here, we describe the refugia and microhabitat use of gopher frogs tracked via radiotelemetry on the Conecuh National Forest in 2021 and 2022. We compare habitat type, ground cover, canopy cover, tree basal area, soil type, and NDVI values of points occupied by gopher frogs (n=23) to random points (n=25) within the maximum observed migration distance from their breeding ponds. Points occupied by gopher frogs were more likely to have less dense canopy cover, less leaf litter, more wiregrass, and lower NDVI values, and were more likely to occur in upland longleaf pine areas with loamy fine sand as compared to random points. Through this study we aim to improve the knowledge base surrounding gopher frogs in Alabama to better inform conservation decisions and aid in the identification of suitable wetlands for restoration based on surrounding land characteristics.

Presenter: Wentao Song

Level of Study: PhD

Category: Forest Resources and Veterinary Medicine

Advisor: Dr. Guiming Wang, Professor, Department of Wildlife, Fishery and Aquaculture

Title: Variations in the responses of North American breeding bird populations to climatic changes

Abstract: Understanding ecological mechanisms underlying variations in the responses of avian populations to climatic change is essential for predicting future avian population trajectories. However, few studies have investigated the interplays of exogenous and endogenous factors on avian population trends. In this study, we fit the Gompertz state-space population models to the population time series of 428 breeding birds in North American from 1970 to 2018. We used structural equation models (SEMs) to evaluate the effects of density dependent and density independent factors on the probability of increasing or decreasing population trends. Bayesian phylogenetic logistic regression indicated that density dependence, delayed density dependence, and the effects of Northern Atlantic Oscillation Index did not differ between 203 increasing and 225 decreasing BBS populations, and only Southern Oscillation Index (SOI) affected the probability of increasing trends. The best Bayesian phylogenetic-tree SEM indicated that the probabilities of increasing population trends were affected by SOI and fledging age, not by density dependence. However, the best multi-level SEM with latent factors and the nested random effects of family and genus suggested that life history traits determined the strength of density dependence and the response levels of birds to SOI. This finding suggests that life-history traits indirectly affected population trends by mediating the effects of climate.

The GSA and Graduate School congratulate all Fall 2023 participants on their contributions to research!

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