5TH ANNUAL July 25th, 2023

SUMMER SCIENCE & ENGINEERING SYMPOSIUM| 2023

Organized By: Mississippi Academy of Sciences and Mississippi State University
Venue: Mississippi State University, Bost Conference Center Mississippi State, (Starkville Campus), MS 39759

Symposium Chairs

Dr. K. Raja Reddy, Chair
Dr. Jason Keith, Co-Chair
Dr. Scott T. Willard, Co-Chair
Dr. Babu Patlolla, MAS President
Dr. Ham Benghuzzi, MAS Divisional Advisor

Scientific Committee Coordinators
Dr. Jamie Larson, Chair
Dr. Raju Bheemanahalli, Co-chair
Dr. Paul Tseng, Co-chair
Mississippi State University
Mississippi State, MS

Awards Committee
Dr. Michelle Tucci, Chair
Dr. Ken Butler, Vice Chair
The University of Mississippi Med. Center,
Jackson, MS

Exhibit Coordinator
Ty Tipton
Thomas Scientific

Major Events

Time	Event
8:30-9:30 AM	Registration, poster set up and breakfast
9:30-10:00 AM	Opening of the event/welcome speeches
10:00-11:30 AM	3-minute oral presentations
11:30-12:00 PM	Networking
12:00-1:00 PM	Lunch break
1:00-3:30 PM	Poster presentations and judging
3:30-3:45 PM	Coffee break
3:45-4:45 PM	Round table discussion
4:45-5:15 PM	Awards and recognitions
5:15 PM	Closing remarks

Symposium Sponsors

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10:00-11:30 AM	3-MINUTE ORAL PRESENTATIONS *Moderators: Dr. Priyadarshini Basu and Dr. Jagman Dhillon* Mississippi State University
11:30- 12:00 PM	NETWORKING
12:00 -1:00 PM	LUNCH BREAK
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3:45-4:45 PM	ROUND TABLE DISCUSSION *Topic: Embracing the Future: Addressing Emerging AI and Data Science Labor Market Expectations* *Moderators: Dr. Michelle Tucci* University of Mississippi Medical Center *Dr. Shrinidhi Ambinakudige* Professor of GeoSciences, Mississippi State University *Dr. Mimmo Parisi* Executive Director, Data Science Program, Mississippi State University *Dr. Jonathan Barlow* Associate Director, Data Science Program, Mississippi State University
4:45-5:15 PM	AWARDS AND RECOGNITIONS *Dr. Michelle Tucci* JMAS, Editor, University of Mississippi Medical Center *Dr. Kenneth Butler* University of Mississippi Medical Center
5:15 PM	CLOSING REMARKS *Dr. K. Raja Reddy,* Symposium Chair

COMMITTEES AND JUDGES

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Paul Tseng, Co-chair

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Gharakhani, Hussein
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Huang, Yanbo
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Li, Xiaofei
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Woolfolk, Sandra
Yu, Fei
Yu, Lixin
Yue, Ziming
Zhang, Ping
Zhang, Xin

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Subramanyam, Bala
Thati, Manikanta
Thenveettil, Naflath

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PRESENTER INDEX

Time	ABBREVIATION
9:30 – 10:45 AM	3M : 3-Minute Oral Presentation
1:00 – 3:30 PM	U-P : Undergraduate Student Poster
	G-P : Graduate Student Poster
	I-P : Investigator Poster
	HS-P : High School Poster

NAME	ID	TITLE
3-MINUTE ORAL PRESENTATION (3M)		
Ahmya M. Clayton	U-3M01	THE EFFECT OF MATERNAL EXPOSURE TO CANNABINOID 1 RECEPTOR MANIPULATION AND ACUTE SEIZURES ON MOUSE FETUSES AT EMBRYONIC DAY 18.5
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Humayun Ahmad	G-3M10	HIGHLY STRETCHABLE AND REVERSIBLE COAXIAL P3HT COMPOSITE FIBER
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ABSTRACTS

3-MINUTE ORAL PRESENTATION (3-M)

U-3M01 THE EFFECT OF MATERNAL EXPOSURE TO CANNABINOID 1 RECEPTOR MANIPULATION AND SEIZURES ON MOUSE FETUSES AT EMBRYONIC DAY 18.5

Ahmya M. Clayton, Maria Jones-Muhammad, Tyranny Pryor, Qingmei Shao, Junie P. Warrington

University of Mississippi Medical Center, Jackson, MS

The endocannabinoid system (ECS), comprising of enzymes, ligands, and receptors, is found within the central nervous system and other organ systems. Studies show that the ECS has an important role in normal pregnancy regulation. With a rise in the use of cannabis-containing products, known to activate the ECS, it is important to understand the acute and long-term effects that maternal use of these products may have on fetal development. The aim of this study was to determine whether acute maternal exposure to cannabinoid 1 receptor (CB1R) agonist and antagonist administered before seizure induction leads to changes in fetal and placental weights, and fetal brain CB1R expression. Pregnant mice underwent sham surgery on gestational day (GD) 13.5. On GD18.5, mice received no treatment, pentylenetetrazol only (PTZ, 40mg/kg), Rimonabant (10mg/kg) + PTZ, or 2-AG (1mg/kg) + PTZ, followed by behavioral recording. Placentas, fetuses, and fetal brains were harvested and weighed. Fetal brains (n=6/group) were selected randomly and homogenized in preparation for Western blotting. There were no significant differences in fetal body or brain weight amongst groups, but placental weight decreased after exposure to 2-AG + PTZ in comparison to other groups ($p<0.01$). CB1R protein expression was not different amongst groups. Taken together, acute agonism or antagonism of the CB1R had no effect on fetal characteristics, but CB1R agonism reduced placental weight. Ongoing and future studies will assess changes in ECS ligands and enzymes in fetal brain and circulation and will assess the impact of repeated maternal exposure on fetal brain development.

U-3M02 EFFECT OF PRENATAL EXPOSURE TO REDUCED UTEROPLACENTAL PERFUSION AND SEIZURES ON COGNITIVE FUNCTION AND TAU PROTEIN IN 2-MONTH-OLD MOUSE OFFSPRING

Andrea Tall, Maria Jones-Muhammad, Tyranny Pryor, Qingmei Shao, Junie P. Warrington

University of Mississippi Medical Center

Children born to mothers with preeclampsia, a hypertensive pregnancy disorder, or eclampsia, new-onset seizures during pregnancy, are more likely to develop learning and memory deficits and are more susceptible to neurovascular diseases compared to those born from normal pregnancies. The contributing mechanisms are not known. In this study, we assessed whether mice exposed to reduced uteroplacental perfusion (RUPP), to mimic preeclampsia or pentylenetetrazol (PTZ) injection (to induce seizures and model eclampsia), developed learning and memory impairment or Alzheimer's disease markers at 2 months of age. On gestational day 13.5, pregnant C57BL/6 mice underwent sham or RUPP surgery followed by injection or no treatment with PTZ (40mg/kg). At 2 months of age, male and female offspring were tested on the Barnes Maze. Mice born to mothers in the RUPP + PTZ took a greater distance to navigate to the escape box compared to Sham + PTZ ($p=0.036$) on Day 1 of the learning acquisition phase. Over time, all mice were able to shorten their distance which indicates that learning ability was not significantly impacted by RUPP or PTZ. However, short-term memory was slightly impacted by exposure to RUPP and seizures. Using ELISA, we found that Tau concentration in hippocampus and cortex was not different between groups. Together, these results suggest that exposure to seizures and/or preeclampsia-like conditions induces modest learning and memory impairment in exposed offspring during young adulthood. Ongoing and future studies will assess learning and memory at older time points and will assess changes in other Alzheimer's disease markers.

U-3M03 DEVELOPMENT OF ELASTIN-LIKE PEPTIDE NFK-B INHIBITOR FOR TREATMENT OF TRAUMATIC BRAIN INJURY

Ian G. McGee, Allie M. Smith, John A. Howell, Jacob Haskell, Gene L. Bidwell, Bernadette E. Grayson

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In the US, approximately 3 million cases of traumatic brain injury (TBI) occur annually. Mild TBI, also known as concussion, is the most common form of TBI. Exposure to TBI can induce brain damage many years following the cessation of injury. Even a single TBI can cause long-term impairments, which can include cognitive dysfunction and anxiety-associated behaviors, that can persist for up to a year post-injury in approximately 15% of injured individuals. Damage to the brain results in the elevation of proinflammatory cytokines. The nuclear factor kappa b (NF-KB) pathway is a transcription factor and master regulator of inflammatory gene expression. Currently, no FDA-approved TBI treatments are available to treat concussion. In the current study, we are investigating novel elastin-like peptide (ELP) NF-KB inhibition (i) for the treatment of TBI. Male Long-Evans rats were fed either a standard diet (SD) or a 40% high-fat diet supplemented with 10% high-fructose corn syrup (HD) for 9 days prior to injury. Rats were anesthetized and intravenously administered fluorescently labeled SynB1-ELP-p50i (50 mg/kg IV) 90 min after either a sham-TBI or TBI induced using the CHIMERA (Closed Head Injury Model of Engineered Rotational Acceleration) (N=6/group). The protein was allowed to circulate for 4 hours after injection, and biodistribution and deposition in the brain were determined by *ex vivo* whole organ imaging using the IVIS. Fluorescently labeled SynB1-ELP-p50i deposited equally in the kidneys and liver of all 4 groups. Plasma clearance in all 4 groups was similar. Overall, there was a statistically significant difference by diet with HD rats having higher ELPi than SD rats, $p<0.05$. There was a trend towards higher intrabrain deposition of SynB1-ELP-p50i in the HD-TBI rats compared to SD rats. TBI alone and HD alone increased BBB permeability and SynB1-ELP-p50i deposition. HD-TBI exacerbated BBB permeability and resulted in the highest deposition. These data suggest that NF-KB inhibition may be a promising candidate for TBI treatment.

G-3M05 TRANSGENIC MODEL OF DIABETES ALTERS ANXIETY-LIKE BEHAVIORS ACUTELY FOLLOWING JUVENILE TRAUMATIC BRAIN INJURY

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Traumatic brain injury (TBI) is one of the leading causes of death in juveniles, and the pediatric population is most likely to sustain a TBI compared to all other age groups. Rates of type 2 diabetes diagnoses in juveniles have almost doubled over the past 20 years. The goal of the current study was to determine if the transgenic rat model of type 2 diabetes (T2DN) would have altered recovery from TBI in comparison to Sprague Dawley (SD) rats. In the present study, male and female T2DN and SD rats sustained either a Sham TBI or a TBI via the Closed Head Injury Model of Engineered Rotational

Acceleration (CHIMERA) on post-natal day (PND30). T2DN and SD TBI recipients exhibited similarly increased time to righting and walking compared to Sham. Subjects participated in one trial of the open field test (OFT) on PND36. Subjects were euthanized on PND37, and brain and blood plasma samples were collected for use in QRT-PCR and insulin assays. Additionally, fasting blood glucose levels were taken on PND25 and at euthanasia. T2DN rats had significantly higher fasting blood glucose levels on PND37 than PND25, with no SD differences at either time. In the OFT, the T2DN TBI rats traveled farther and tabulated increased ambulatory time, ambulatory counts, and horizontal counts ($p < 0.01$) compared to T2DN Sham animals. SD Sham and TBI behavior in the OFT was unremarkable. Genetically modified young diabetic rats demonstrate a proclivity toward altered behavior patterns compared to controls.

G-3M06 EFFECTIVENESS OF OMEKA VIRTUAL COLLECTIONS FOR ENGAGING DUNN-SEILER MUSEUM AUDIENCES

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Museums have been an important part of human history for centuries because of their preservation of important artifacts and cultural relics. Traditionally, visitors had to travel to the museum to view artifacts and specimens in a gallery. Lack of museum access has been a continuing issue for low-income visitors, and it became a problem for all during the Covid-19 pandemic. The creation of virtual museum collections, including website collections like the Omeka Virtual Platform, allow scientists to share museum collections with a larger audience because visitors are constrained by financial or geographic barriers. This study investigated the effectiveness of the Dunn-Seiler Museum's Omeka Virtual Platform for learning outcomes. The Dunn-Seiler hosts a small public gallery in the Department of Geosciences at Mississippi State University. We researched how virtual museum platforms compared with in-person informal outreach with respect to learners' content gains and affective responses to activities that investigated fossil specimens (virtually and hands-on) that demonstrated both higher and lower sea levels in Mississippi's geologic history. The research was conducted in middle-level classrooms within two school districts in Mississippi (N = 99 students). Analysis of pre- and post-assessments of control (hands-on) and experimental (virtual specimens) groups revealed that there was no significant difference in content gain or affective response when student data were reviewed in aggregate for control vs. experimental groups. These results suggest that virtual fossil specimens offer a comparable experience to hands-on specimens within museum outreach.

G-3M07 TITANIUM ANODIZATION TO FORM HYDROXYAPATITE AND TRICALCIUM PHOSPHATE COMBINATION SURFACES

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Traditional plasma-sprayed hydroxyapatite coatings on titanium have been shown to improve osseointegration but possess less than desirable adhesion strengths which can result in delamination and implant loosening. Hydroxyapatite-containing anodized coatings have shown to be stronger than the plasma-sprayed hydroxyapatite coatings. In the present study, commercially-pure titanium discs were anodized using pulsed-galvanostatic waveforms in a series of four novel electrolytes to form oxides consisting of strategic combinations of alpha-tricalcium phosphate and hydroxyapatite. Optical and Scanning electron Microscopy (SEM), thin film x-ray diffraction (XRD), laser confocal microscopy (LCM), electron dispersive spectroscopy (EDS), and Fourier transform infrared spectroscopy (FTIR), were utilized to characterize the oxide surfaces. SEM and LCM analyses revealed petal-like structures and multiscale roughness profiles in two oxides. XRD analyses on these oxides revealed alpha-tricalcium phosphate and hydroxyapatite combinations. EDS results on these revealed substantial Ca and P uptake with Ca/P ratios in range of 1.4 - 2.1. FTIR analyses revealed high intensity and sharp phosphate (1025 – 1200cm^{-1}) and carbonate (880,1750 and 1450cm^{-1}) peaks for these oxides. The present study showed formation of oxides consisting of strategic combinations of alpha-tricalcium phosphate and hydroxyapatite by anodization. The characteristic petal-like structured appearance on SEM analysis indicated the formation of hydroxyapatite. Further, the presence of sharp carbonate peaks on FTIR analysis indicated the presence of a highly crystalline carbonated or bone-like apatite formation. This study formed chemically and topographically enhanced carbonated hydroxyapatite and alpha-tricalcium phosphate combination oxides that show much promise for improving bone to implant contact around future implants.

G-3M08 COMPARISON OF INITIATORS TOWARDS THE SYNTHESIS OF DEGRADABLE POLY(STYRENE-CO-ACETAL) FROM BIO-BASED PRECURSOR

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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.

G-3M09 NAVIGATING STELLAR ACTIVITY OF YOUNG STARS TO VALIDATE TESS PLANETS AROUND K DWARFS

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We present preliminary results for the characterization of two TESS-discovered, sub-Neptune mass planetary candidates in orbit around relatively young host stars. GJ 105.5 b has an orbital period of 15.669±0.002 days and a radius of 2.69±0.55 Rearth orbiting an adolescent K dwarf. To both confirm the planet and constrain its mass as well as search for additional planets, we obtained high-spectral resolution spectroscopy with the infrared iSHELL spectrograph on the 3m NASA/IRTF telescope and the optical NEID spectrograph on the WIYN 3.5m telescope at Kitt Peak National Observatory. These specially designed echelle spectrographs utilize a methane gas cell and laser frequency comb, respectively, from which we are able to achieve precise radial velocity (PRV) measurements of 1 to 3 m/s precision. TOI 139 b has an orbital period of 11.071±0.00004 days and a radius of 3.079±0.31

Rearth. The host star exhibits two youth indicators; the TESS light curve contains a photometric rotation period of ~8 days which is consistent with that of a youthful K dwarf, and the spectrum shows chromospheric emission excess as indicated by Ca II H & K emission lines. This target has public HIRES PRV measurements obtained on the 10m Keck I telescope and extracted using the SERVAL pipeline which demonstrates precision of 2 m/s. We also employ the infrared iSHELL spectrograph to gather additional PRV measurements on this target. Combining PRV measurements at visible and near-infrared wavelengths reduces the impact of star spots or other sources of stellar variability on the time series which can be misinterpreted as a planetary signal. PRVs from both spectrographs are jointly modeled with a *chromatic* Gaussian Process (GP) kernel which takes advantage of the wavelength dependency of stellar activity on the RV time series. In this poster, we will outline the process of PRV extraction and modeling, explain how the GP model accounts for stellar activity, and present preliminary results of the mass and orbital parameters from the PRV measurements completed so far. Identifying the properties of planets around adolescent stars will fine-tune our understanding of young solar systems. We aim to collect additional PRV measurements to confirm both of these planet candidates, so we may contribute to the number of known planets around youthful, K dwarf stars.

G-3M10 HIGHLY STRETCHABLE AND REVERSIBLE COAXIAL P3HT COMPOSITE FIBER

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Conjugated polymers have potential applications in many areas including in wearable electronics, healthcare devices, electronic skin, and flexible displays. For these applications, it is important that the polymer maintains electronic properties with mechanical deformation. Achieving such is a significant challenge, as the performance of many systems deteriorates under stretched conditions. Here, we report the fabrication of highly stretchable composite fibers consisting of semiconducting poly(3-hexylthiophene) (P3HT), and butyl rubber (BR) obtained using a coaxial electrospinning technique. BR, an elastomer, was used in the core, whereas P3HT was used in the shell to obtain coaxial stretchable fiber. The polarized optical microscopy analysis captures the ordered structure present in the fibers. Photoluminescence spectroscopic study of the fiber mat captured as high as 12 nm red-shift for 0-0 aggregation peak in the stretched fibers. This red shift signifies the change of ordered structure in fiber due to the application of tensile load along the strain direction. The fibers were highly stretchable, as the ruptures strain of the electrospun fiber was approximately 1000%. The electrical conductivity values at different strain conditions were recorded. Electrical conductivity did not change significantly up to 400% strain. Further, the conductivity is maintained for this applied strain under cyclic loading, showing excellent mechanical and electrical durability of the fibers. Besides, other matrix components were successfully used as a core for developing core-shell P3HT fibers, demonstrating the general applicability of our spinning approach. Our results show that the electrospun fibers obtained here can have applications in wearable and deformable electronic devices where high stretchability is required.

G-3M11 HIGH-POWER LASER IRRADIATION PRODUCES MORPHOLOGICAL CHANGES IN ULTRA-TRANSLUCENT ZIRCONIA

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Removing zirconia restorations is a challenge, especially when diamond burs are used. This method is merely destructive of the restoration itself as it breaks it apart. We aimed to use a drill-free method and assess the topography and morphology of an ultra-translucent zirconia ceramic after irradiation with an Er,Cr:YSGG laser. Zirconia slices of 1 mm thickness were laser irradiated for 120 s using power levels of 1, 4, 6, or 7.5 W. Surface roughness and morphology of the irradiated area were assessed before and after laser irradiation for each power level group (n=3/group). Surface roughness data were statistically analyzed using repeated measures two-way ANOVA. The surface roughness of zirconia for the 1, 4, 6, and 7.5 W groups before irradiation were 3.94 ± 0.42, 3.95 ± 1.91, 4.25 ± 1.54, and 4.6 ± 1.16 µm, respectively. The surface roughness for the 1, 4, 6, and 7.5 W groups after irradiation were 3.4 ± 0.37, 4.14 ± 1.97, 4.6 ± 1.55, and 5.1 ± 1.39 µm, respectively. The interaction between the power and treatment condition significantly affected surface roughness (p=0.008). A power level of 7.5 W significantly increased the surface roughness, whereas a power level of 1 W significantly decreased it. Changes in the morphology were observed for the 6 and 7.5 W group. Macroscopically, black spots were seen on the surface at random positions. Microscopically, those black spots were seen as melted areas with microcracks having a crater-like appearance. The highest laser power irradiation increased the surface roughness of the ultra-translucent zirconia ceramic. Microcracks were seen when high power levels (6 and 7.5 W) were used. Clinicians should be aware that using high power levels to remove zirconia restorations might prevent re-use them.

G-3M12 EVALUATING THE POTENTIAL PROBIOTIC FUNCTIONS OF TWO AUTOCHTHONOUS INTESTINAL BACTERIA FROM HYBRID CATFISH

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The intestinal microbiome can influence the physiological and immune responses of the host. Probiotics are microorganisms that can be beneficial to the host and have been investigated for their potential to improve growth and disease resistance in aquatic animals. In this study, novel autochthonous probiotics for hybrid catfish were evaluated for potential use in the catfish aquaculture industry. Two autochthonous probiotic candidates, *Lactococcus lactis* MA5 and *Cetobacterium somerae* MSU49, identified from previous investigations, were subjected to advanced assessment of their potential functions by whole genome sequencing. Their potential probiotic traits such as the ability to produce vitamins and amino acids, and tolerance to acidic conditions and osmotic stress were analyzed. Notably, three bacteriocin genes were identified in the *L. lactis* MA5 genome while the *C. somerae* MSU49 genome contained genes for vitamin B12 biosynthesis. These traits benefit the host by inhibiting proliferation of pathogenic bacteria and providing essential nutrients. In addition, a protectant medium for preserving *L. lactis* MA5 under lyophilization treatment was examined. The result indicated the lyophilized bacteria could be stored at 4°C for up to 14 days with a survival rate: of 69.8 ± 1.65% which improved to 83.0 ± 6.22% when alternatively stored at -20°C. Control groups lyophilized in the saline solution presented a survival rate of 0.5 ± 0.40% at 4°C and 1.9 ± 2.44% at -20°C. In conclusion, two bacterial isolates are expected to be probiotics with the potential for use in the hybrid catfish industry based on physiology regulation, bacterial inhibition, essential nutrient biosynthesis, and stability.

G-3M13 C H FUNCTIONALIZATION OF INDOLE WITH DIAZOACETATE CATALYZED BY A CCC-NHC Ir (III) DIMER COMPLEX

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Since the discovery of N-heterocyclic carbenes (NHCs) as a stable carbene, several classes of NHC have been synthesized, and their application as a ligand in metal complexes has received much

attention due to strong σ-donor with deficient π-acceptor nature. The first catalytic application of a CCC-NHC pincer Ir (III) dimer complex for the C−H functionalization of N-methylindoles with α-aryl-α-diazoacetates at the C-3 position is reported herein. The Ir pincer dimer complex was used as a catalyst at 3 mol% loadings. The best reaction conditions involved a combination of catalysts and substrates in a specific order. It activated the C-H bond by forming a new C-C bond to generate α-aryl-α-indolyl acetates with more than 99% conversion at room temperature without requiring additives. Isolated 84-97% yields were obtained for a range of substrates. Under these catalytic conditions, the unprotected N-H indoles did not react with α-aryl-α-diazoacetate. These catalytic conditions provided an efficient synthetic route to synthesizing α-aryl-α-indolyl acetates. Plausible mechanisms are also proposed for reaction.

G-3M14 VISUALIZING BLOOM-TIME VARIATIONS IN Asclepias (Milkweeds) ACROSS MISSISSIPPI

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Milkweeds are important nectar and host plants for many species of butterflies, bees, and true bugs. Each of Mississippi's milkweed species bloom and fruit at different times. Patterns in local and regional milkweed bloom times may partially explain divergent pollinator preferences at different times of year. Furthermore, range overlap of pollinators and milkweeds may determine the relative significance of milkweed floral resources in individual pollinator diets. Citizen science data from iNaturalist was annotated and mapped in an ArcGIS Dashboard. The data indicate that Mississippi milkweeds bloom at different times than conspecific milkweeds in other regions of the United States and that insect floral preferences may be influenced by temporal and geospatial overlap with blooming milkweeds. This research demonstrates the feasibility of studying continental trends in plant phenology and pollinator ecology using iNaturalist data.

G-3M15 CARBOXYLESTERASE 1 (CES1) REGULATES INFLAMMATORY CYTOKINES IN HUMAN MACROPHAGES

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Macrophages are important cells of innate immunity. They respond directly to pathogens, tissue damage and alert the immune system. They are polarized toward a microbicidal and proinflammatory phenotype that secrete high levels of toxic cytokines. This is vital for fighting infection and for ensuring homeostatic equilibrium. However, if left unchecked, the long-term establishment of such cellular activities can promote disease. For example, non-resolving proinflammatory macrophages can lead to diabetes and atherosclerosis. Carboxylesterase 1 (human/murine nomenclature: CES1/Ces1d) is a member of the serine hydrolase superfamily that catalyze the hydrolysis of carboxyl ester containing drugs and lipids. They have been shown to regulate triacylglycerol (TAG) levels in macrophages. TAG levels also impact inflammatory profile. CES1 was knocked down by transduction of THP-1 monocytes with lentiviral CES1 shRNA construct. RT-qPCR and RNA SEQ were used to estimate mRNA levels, while ELISA was used to estimate protein content. Knocking down CES1 was hypothesized to impact inflammatory cytokines. RT-qPCR data showed CES1 knockdown (CES1KD) THP-1 macrophages after differentiation produced significantly higher levels of inflammatory cytokines mRNA *IL1β, TNFα* but not *IL6* when compared to macrophages that express normal levels of CES1 (control). From the Gene ontology pathways that were upregulated in an RNA-seq dataset, CES1KD cells exhibited higher levels of inflammasomes genes and those that respond to fighting infection. There was also an increase in IL1β protein 24 hours after differentiation. These results suggest there might be a relationship between CES1 effect on TAGs level and inflammatory cytokines production.

G-3M16 FIELD PERFORMANCE OF BIOSTIMULANTS IN CORN PRODUCTION

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Biostimulants are substances that modify plant physiological processes and enhance yield, N uptake, and reduce environmental perturbations. Previous research has primarily focused on horticultural crops under control environmental conditions and lesser importance given for cereals especially corn under field conditions. Therefore, a study was conducted at two different locations within Mississippi (MS) testing biostimulants. The objective of this study is to evaluate impact of biostimulants on corn yield at variable nitrogen rates. Field trials were conducted at two experimental stations at Starkville and Stoneville, MS. A total of 36 plots including 12 controls were replicated four times within a split-plot design where N rate was the main plot factor. Six commercially extracted microbial biostimulants (Source®, Envita, iNvigorate®, Blue N, Micro AZ^{TM}, and Bio level phosN) at their recommended rates were foliar dispensed at V4-V5 stages as subplot factors. Four different N rates 0, 89, 179, and 269 kg N ha^{-1} at Starkville, whereas an additional rate of 224 kg N ha^{-1} were incorporated at Stoneville in 2022. Within the first year, Stoneville observed significant yield differences with N rates and biostimulants with yield ranging from 7.5 to 13 Mg ha^{-1} whereas Starkville did not. Additionally, no interaction effects were noted at either location. Specifically, yield increased with the application of 89 kg N ha^{-1} over the check plot, and no significant differences were noted between 89 kg N ha^{-1} and higher N rates. Significant differences were noted within biologicals. However, this was not statistically different from the check plot where no biological was applied.

G-3M17 MWAM: MULTIRESOLUTION WAVELET ATTENTION MODULE

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Attention mechanisms have proven effective in improving the performance of convolutional neural networks (CNNs) by enabling the network to focus on the essential parts of an image. However, CNNs are inherently constrained by fixed filter sizes, limiting their ability to capture information at different resolutions. To address this limitation, we introduce the Multiresolution Wavelet Attention Module (MWAM), which leverages Discrete Wavelet Transform (DWT) and Inverse Wavelet Transform (IWT) to overcome the challenges imposed by fixed filter sizes. The network can capture features at multiple resolutions by incorporating the MWAM into any CNN architecture. The proposed module tackles fixed filter size issues by adaptively attending to important features across various scales. This unique approach allows the network to capture fine-grained details and coarse-grained contextual information simultaneously, leading to a comprehensive representation learning process. The proposed attention achieves significant performance enhancements in baseline ResNet-50 networks while introducing fewer parameter increases. The MWAM introduces a novel approach to improving feature selection and enhancing performance across diverse datasets and tasks by combining wavelet transforms and attention mechanisms. The module's lightweight nature also enables seamless integration into existing CNN architectures. In the MWAM architecture, the input image X is decomposed into low and high-frequency subband images, *XLL, XLH*, *XHL*, and *XHH,* using 2D DWT. While the high-frequency component *XHH* is known to retain noise and potentially degrade performance, we discard it to focus on the essential components. The *XLH* and *XHL* subband

images are then processed, concatenating along the channel to enrich features. Then the Softmax operation is applied to the resulting features before multiplying it with the *XLL* subband image features, generating an attention map. The resulting attention map captures detailed information while preserving low-frequency information. To ensure that fine-grained information lost during the down sampling process is captured, we apply IWT to the attention map. This allows the module to capture local and global contextual information by fusing multiresolution information. Additionally, the IWT helps mitigate information loss by reconstructing high-resolution details. This integration of IWT ensures seamless compatibility with existing CNNs, eliminating any size mismatch issues. Finally, 1*x*1 convolutions and adaptive average pooling operations are performed to focus on the important channels. To evaluate the effectiveness of the proposed module, experimental evaluations were conducted on both classification tasks using ResNet-50 on CIFAR 10/100 datasets and object detection employing Faster R-CNN with the MS COCO dataset. The results demonstrate a significant performance improvement in both classification and object detection tasks, showcasing the effectiveness of the MWAM in capturing and leveraging multiresolution information to enhance accuracy and robustness. In summary, the proposed work presents a novel approach to overcome the limitations of CNNs imposed by fixed filter sizes. By incorporating DWT and IWT, the module enables the network to capture features at multiple resolutions, leading to improved performance in classification and object detection tasks. The proposed architecture and ability to capture and leverage multiresolution information contribute to advancing attention mechanisms in deep learning.

G-3M18 EFFECT OF REDUCED UTERO-PLACENTAL PERFUSION AND ACUTE SEIZURE EXPOSURE ON COGNITIVE FUNCTION AND TAU PROTEIN IN MICE AT 2 MONTHS POSTPARTUM

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Preeclampsia (PE), a hypertensive pregnancy disorder, is characterized by new-onset hypertension after 20 weeks of gestation with symptoms impacting many organ groups. With the addition of new-onset seizures, PE can progress to eclampsia. Though PE is thought to resolve after the fetus is delivered, studies have shown increased risk of vascular dementia and mortality from Alzheimer's disease in women with a history of PE. The goal of this study was to determine whether a mouse model of preeclampsia (the reduced uteroplacental perfusion (RUPP)) and eclampsia (pentylenetetrazol (PTZ, 40mg/kg) to induce seizures), display learning and memory deficits and Alzheimer's disease markers at 2 months postpartum. Pregnant C57BL/6 mice underwent sham or RUPP surgery on gestational day 13.5 and injected with PTZ or left untreated on GD 18.5. Two months after delivery, cognitive function was assessed using the Barnes Maze. Mice exposed to RUPP during pregnancy took a longer distance to the escape box on Day 1 of learning compared to Sham-exposed dams. All mice eventually learned the task, resulting in no significant effect of RUPP or Seizure on short-term memory. Using ELISA, we found that seizure exposure led to increased total Tau in the cortex ($p=0.018$) with a significant increase in sham group. Together, these results indicate that a history of RUPP leads to modest learning impairments and seizure exposure during pregnancy increases cortical Tau postpartum. Ongoing and future studies will assess changes in other Alzheimer's disease markers and determine whether increased postpartum time will lead to exacerbate learning impairment.

I-3M19 CALIBRATION OF AN OPEN-SOURCE APPLICATION FOR MEASURING FRACTAL SURFACES

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Fractal geometry of ceramic fracture surfaces was previously used to determine the fracture toughness of prostheses and implants that failed *in vivo*, but the software application used in the past to analyze those surfaces is no longer compatible with current platforms. We sought to calibrate a newer application (Gwyddion) that is free-of-charge, open-source, and available for current versions of MS Windows, Mac OS, and Linux. Matlab (MathWorks) was used to create fractal surfaces having known dimensionality. The surfaces spanned the range of fractal dimensions previously observed for ceramic fracture surfaces ($D = 2.1, 2.2, 2.3$, and 2.4), and they were generated at three different levels of resolution (256x256, 512x512, and 1024x1024 pixels), resulting in $n=10$ surfaces per dimension per resolution ($10x4x3=120$). The fractal dimension of each surface was estimated using the cube counting algorithm in Gwyddion (Czech Metrology Institute). The cube counting method did not accurately estimate D, but the error values fit well to a linear model, so that a simple equation could be developed to correct the estimates. After correction, the mean D values were accurate and precise for surfaces of all resolutions. The 1024-pixel surfaces yielded slightly lower coefficient of variation (0.8%) compared to the 256-pixel surfaces (1.1%). Fracture surface D values estimated by cube counting in Gwyddion were easily corrected to be accurate and precise using a linear equation. Both accuracy and precision were slightly higher for surfaces with higher resolution.

POSTER (P)

UNDERGRADUATE STUDENT POSTER (U-P)

U-P01 SUBSTRATE ANALYSIS OF RECOMBINANT YfdV and YhjX, A PUTATIVE TRANSMEMBRANE ANTIPORTER IN *Escherichia coli*

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Escherichia coli has developed several systems for efficiently enduring environmental stress. The systems allow *E.coli* to survive extreme acidic conditions as low as a pH of 2 for several hours. The mechanisms of some of the systems have been well studied, including the import and decarboxylation of amino acids such as glutamate and arginine. These systems must share two common requirements to work, which are a decarboxylase and an antiporter protein. Our lab has previously shown that two enzymes, OXC and FRC, come together to fulfill the decarboxylase requirement and hypothesize that the *yfdV* or *yhjX* gene product is the antiporter needed for the system. We will be developing and using a 3D-printed chamber assay that utilizes LC-MS to detect the transport of small organic acids, likely to be oxalate, formate, and/or acetate, across a membrane infused with recombinant *YfdV or YhjX.* Currently, we have cloned both *yfdV* and *yhjX* into an expression vector and over expressed both proteins.

U-P02 NMR FOR HYDROLYSIS OF METHENAMINE TO FORMALDEHYDE

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As the world's carbon dioxide footprint has become more apparent, subsurface storage of CO2 has been explored as a solution. An issue that might compromise this solution is the leakage of CO2 back to the surface. In order to prevent CO2 leakage, CO2-sensitive chemicals may be injected into the leak-prone areas of the subsurface reservoirs. These compounds convert from liquid into gel or solid when they encounter CO2, and subsequently block the leakage pathway. One such CO2-sensitive chemical, that is the subject of this study, is composed of methenamine, resorcinol, and polyacrylamide. Methenamine, which has applications in pharmaceuticals and resin production as well, is key in triggering the gelation process. It is believed that the aqueous solution of methenamine hydrolyzes into formaldehyde under the acidic condition induced by CO2. However, information on the kinetics of methenamine hydrolysis and its products is limited. Here we study the kinetics of methenamine hydrolysis into formaldehyde and identify the other products of this reaction through NMR spectroscopy. Our results demonstrate how formaldehyde is produced as a result of methenamine hydrolysis under different acidities and temperatures. These findings will assist with the optimization of CO2-induced gelation and understanding the mechanism of methenamine-based drugs for bacterial infections.

U-P03 AUTOLOGOUS BONE REPLACEMENT, BONE REMODELING AND NEURONAL ASSESSMENT FOLLOWING CRANIOPLASTY

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Head injury in trauma is associated with deleterious consequences, and is often associated with the need for cranioplasty to relieve brain swelling. High impact force to the head is also positively associated with long-term inflammation which is associated with progressive loss of learning and memory. The objective of the current study was to determine the healing and resorption rates of cranial defects in animals, along with evaluating the potential for inflammation-mediated changes in neuronal behavior and healing. Three experimental groups were included in a 5-mm central critical-sized cranial defect model with Sprague-Dawley rats: (1) sham operated, (2) empty defect, (3) placement of autologous bone. Neurobehavioral assessment was determined biweekly and characterization of bone remodeling performance were determined at the 8-week-endpoint. Our data showed that the empty defect group decreased short-term memory two, four, and six weeks after surgery, but the bone placement group only decreased short-term memory two and four weeks with recovery six weeks after surgery. The bone remodeling, as determined by dual-energy X-ray absorptiometry (DEXA) scan and micro-CT analysis showed that the bone placement group achieved the most enhanced bone growth compared to the empty defect group eight weeks after surgery. Our results suggest that autograft enhanced bone repair in our cranial defect rat model with a reduction in cranial defect-induced neurobehavioral dysfunction.

U-P04 CREATING A PHENOLOGY WHEEL FOR THE SOUTHEAST REGION

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Beekeepers often choose the habitat for bees without an understanding of the nutritional quality of nearby plant pollens. Better understanding of floral resources would aid researchers as they aim to strengthen bee populations, which are critical for agricultural production worldwide. The objective of this project is to create a database of pollen samples collected throughout the state of Mississippi that beekeepers and researchers can use to improve their knowledge of bee habitats. The database will show the phenology of numerous plant species. The project involves working with citizen scientists to obtain pollen samples. In processing the samples, we rely on color sorting and acetolysis. The long term goal of the project is for the Mississippi data to be part of a larger database of pollen nutritional composition. The availability of that data will increase understanding of the phytosterol requirements of bees and allow farmers and conservationists to make better informed decisions when designing habitats aimed to optimize bee health.

U-P05 GEOSPATIAL INVENTORY OF ON-FARM WATER STORAGE SYSTEMS FOR IRRIGATION IN NORTHEAST MISSISSIPPI

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The Blackland Prairie region of Mississippi receives an average of 131 cm of annual precipitation with only 37% of that precipitation occurring during the growing season. The number of irrigation systems and surface water storage in northeast Mississippi has increased over recent years to supplement rainfall and reduce risk. An on-farm water storage (OFWS) system captures and stores precipitation and irrigation runoff while simultaneously capturing

nutrients to mitigate stream impairment. Runoff during the off-season will be stored in the OFWS for maximized use in the growing season. OFWS systems, over recent years, have been privately funded due to minimal federal cost assistance for the region, so the amount of storage systems and irrigated acres are likely underestimated. An inventory of OFWS systems was conducted for 22 counties in northeast Mississippi to determine a baseline of surface water storage for irrigation. National Agriculture Imagery Program (NAIP) imagery, in conjunction with Google Earth, was used to conduct the inventory. The NAIP imagery was input into Esri's ArcMap software where a grid was overlaid onto the image so that each section could be analyzed for OFWS and center pivot irrigation systems. When identified on the NAIP imagery, OFWS systems were digitized into a polygon shapefile, and a single point was used to mark the center pivots with another polygon shapefile outlining the irrigated area. To date, 883 hectares of surface water storage have been identified, along with 6537 hectares of irrigated acres. Ground-truthing of 50% or more of the systems is ongoing.

U-P06 DEVELOPMENT OF A PORTABLE DEVICE TO MEASURE ADHESION STRENGTH OF GECKO TOEPADS

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Geckos are reptilian species known for their unique ability to adhere to virtually any surface. This ability to "stick" comes from weak intermolecular forces, otherwise known as Van der Waals forces, produced by hair-like setae on their toe pads. These Van der Waals forces can be decomposed into two forces: normal forces (Y-direction) and frictional forces (X-direction). Many studies have evaluated either the normal or frictional force, but limited evidence exists from measuring both simultaneously. Measuring the two forces at the same time gives the ability to find the ratio of the normal force to the frictional force. This ratio regulates to what extent geckos can use their toe pads. Our objective was to develop a lightweight and portable device to measure both normal and frictional forces of geckos on the surface. To this end, we have developed a device that consists of a 3-axis load cell, an aluminum and polycarbonate plate, t-slotted framing, and a digital force gauge. Force data is acquired and recorded through LabVIEW. Preliminary experiments involved attaching the digital force gauge to two crested via a ribbon harness and pulling the geckos at a 0-degree angle with respect to the polycarbonate plate. Results from these trials showed an expected ratio of normal to frictional force. The ratios found were compared to those found in previous studies on friction and normal forces measured separately. For future work, this device will be used to test the adhesion strength of day geckos at the Mauritius Islands in August.

U-P07 MICROGLIAL SUPPRESSOR AZITHROMYCIN ATTENUATES LIPO-POLYSACCHARIDE-INDUCED NEUROBEHAVIORAL DYSFUNCTION, BRAIN INFLAMMATION AND OXIDATIVE STRESS IN NEONATAL RATS

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Increasing data provide support for the hypothesis that microglia activation-related pro-inflammatory cytokines mediate inflammation-induced injury to neonatal brain. Our previous studies have shown that systemic administration of endotoxin lipopolysaccharide (LPS) induces sensorimotor neurobehavioral dysfunction and brain inflammation in neonatal rats, which is associated with the production of pro-inflammatory cytokines by activated microglia. The objective of the current study was to determine whether azithromycin, a putative suppressor of microglial activation, attenuates LPS-induced brain inflammation and neurobehavioral disturbances. Intraperitoneal (i.p.) injection of LPS (2 mg/kg) was performed in P5 rat pups and azithromycin (40 mg/kg) or vehicle (PBS) was administered (i.p.) 5 min after LPS injection. Control rats were injected (i.p.) with sterile saline. Neurobehavioral tests were performed and brain inflammation and oxidative stress was examined on P6, 24 hours after LPS exposure. Our results showed that azithromycin treatment significantly reduced LPS-induced neurobehavioral deficits including allodynia, hyperalgesia, reduction in pre-social interaction (ultrasonic vocalization), and sensorimotor neurobehavioral deficits in righting reflex, negative geotaxis, wire hanging maneuver, and hind limb suspension tests in P6 rats. Azithromycin also attenuated LPS-induced increase in IL-1β levels and thiobarbituric acid reactive substances (TBARS) contents in the P6 rat brain and spinal cord. These results suggest that microglial suppressor azithromycin may provide protection against systemic LPS exposure-induced brain inflammation, lipid peroxidation, and neurobehavioral dysfunction, and that the protective effects are associated with its ability to attenuate LPS-induced microglia activation-related pro-inflammatory cytokines.

U-P08 PHOTOCHEMISTRY OF AROMATIC IMIDES: SYNTHETIC POTENTIAL AND RADICAL ANIONS IN AQUEOUS SOLUTION

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Aromatic imides show a wide range of photochemical activity. Phthalimides can cyclize and form medium to large rings upon irradiation in aqueous solution, tolerates several functional groups and gives excellent yields. This decarboxylative photocyclization of phthaloyl □-carboxylic acids is a triplet biradical reaction that can even force cyclohexane into unfavorable boat conformation. Pyromellitimide (1,2,4,5-Benzenetetracarboxylic acid diimide) is widely used in polymeric films (Kapton) due to its high thermal stability, good mechanical properties, low dielectric constant, low coefficient of thermal expansion and high radiation resistance. Additionally, the characteristic absorption of the radical anion at 720 nm makes pyromellitimide an attractive component of electron-transfer cascade systems. Pyrolmellitic imide also undergoes the decarboxylative photocyclization, even though the preparative value is limited due to the large number of regio- and stereoisomers formed. Conveniently, the reaction can be monitored via UV/Vis spectroscopy by the radical anion absorption at 720 nm. The photochemistry of mellitic imides has so far not been investigated. Even the synthesis of the mellitic imides is not as straightforward as for other imides. Here we report our progress on the synthesis and photochemistry of mellitic imides with □-carboxylic acids.

U-P09 THE EFFECTS OF NPY Y1 ANTAGONIST ON PAIN AND GAIT FOLLOWING CHRONIC CONSTRICTION NERVE INJURY IN A RAT MODEL

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Chronic pain is a condition in which pain progresses from an acute to chronic state and persists beyond the healing process interfering with the patient's quality of life. Chronic constriction injury (CCI) of the sciatic nerve is a peripheral nerve injury widely used to induce mononeuropathy and create chronic pain. Injuries to the sciatic nerve can result in changes in gait, coordination, and balance and is a sensitive way to determine if treatments are effective. We have

shown in our lab, increased neuropeptide Y levels and increased Y1 receptor following CCI in the forming neuroma. The objective of our current study was to administer a Y-1 antagonist to reduce pain and improve sciatic functional index (an assessment of gait), and assess the histology of the developing soft tissue neuroma. Fifteen Sprague Dawley rats were divided into three groups. Baseline measurements for pain and gait were assessed prior to surgery. The sciatic nerve in all animals was exposed. In the sham control group (n=5) no constriction was applied, and in the experimental groups four sutures were placed around the sciatic nerve. Animals in group 2 (n=5) were given saline as therapeutic treatment. Animals in group 3 (n=5) were provided daily injections of NPY 1 Receptor antagonist (5 ng). Four days following surgery body weights, pain and gait were assessed, then the experimental groups were given either saline (VEH) or Y1R-ANT for 14 days, and re-assessed for pain on Monday, Wednesday, and Friday of each week. Gait was assessed along with body weight weekly. Histology of the sciatic nerve and dorsal horn of the spinal cord was assessed at the end of 14 days and compared with naïve control (sham surgery), and saline treatment. Our data showed significant reduction in pain, a significant (25%) improvement in the sciatic functional index score (SFI), and changes in the number of Schwan cells in the group receiving the Y1R-ANT when compared to animals receiving VEH only. The use of a selective Y1-R ANT may offer significant improvement for neuropathic pain following nerve injury.

U-P10 QUANTUM YIELD OF VISIBLE WAVELENGTH PHOTOCLEAVAGE OF DNA

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Photocleavage of DNA has many potential therapeutic and technological applications. In medicine, controlled cleavage of DNA is used in photodynamic cancer therapy. Optimal quantum yields are required for any photochemical reaction, but the quantum yield of DNA photocleavage reactions have not extensively been investigated. Quantum yields are required though to optimize the photon efficiency, but also for mechanistic understanding and reaction optimization. Here we report a novel chemical process for photocleavage of DNA that uses light of visible wavelength. From a cationic precursor the reaction generates an alkoxy radical that initiates cleavage by abstracting a hydrogen atom from the DNA deoxyribose backbone. Quantum yield measurements support the proposed mechanism, identify the energy wasting process and allow optimization of the reaction efficiency.

U-P11 BOTH INTRAUTERINE GROWTH RESTRICTION AND MATERNAL INFLAMMATION ENHANCE SUSCEPTIBILITY TO ISCHEMIC STROKE-INDUCED NEUROBEHAVIORAL DEFICITS AND BRAIN DAMAGE AND IN ADULT RATS

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Epidemiological and experimental studies suggest a link between both maternal inflammation and intrauterine growth restriction (IUGR), and increased an risk to develop diseases later in life. However, susceptibility to ischemic brain injury in maternal inflammation or IUGR individuals is poorly understood. This study tested whether maternal inflammation or IUGR rats have greater ischemic brain injury compared to control rats. Maternal inflammation or IUGR was induced in rat offspring using lipopolysaccharide (LPS, 100 µg/kg) intraperitoneal injection or reduced uterine perfusion pressure (RUPP) procedure during late gestation, respectively. At 5 months, maternal inflammation, IUGR and control animals were exposed to middle cerebral artery occlusion (MCAO) to induce stroke. Motor skills and sensory tests were assessed 24 hours post-stroke followed by euthanasia to collect brain tissue for assessment of ischemic damage. Our results show that offspring from dams exposed to LPS or RUPP exhibited significant hypomotor activity, hyperalgesia, and reduced brain volume compared to control offspring. Maternal inflammation and IUGR rats showed greater motor and sensory deficits compared to control rats as assessed with the modified neurological severity score after the MCAO procedure. Both LPS-induced maternal inflammation and RUPP-induced IUGR enhanced adult susceptibility to MCAO-induced ischemic brain injury in adult rats, including increases in damage volume, and reduction in neuron numbers (NeuN+). These results suggest that both maternal LPS-induced and RUPP-induced brain dysfunction in rats may enhance adult susceptibility to ischemic brain injury. Our model may be useful for studying mechanisms involved in ischemic brain injury and the development of potential therapeutic strategies.

U-P12 DESCRIBING THE CONSUMPTION OF CHLORTETRACYCLINE-CONTAINING SUPPLEMENT OFFERED FREE-CHOICE TO COMMERCIAL BEEF COWS ON PASTURE

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Study objectives were to describe the consumption patterns of a granular chlortetracycline (CTC)-containing mineral supplement and evaluate the effect of age on consumption by cattle on pasture. A total of 103 crossbred cows were allocated to 1 of 3 pastures equipped with a SmartFeed (C-Lock Inc.) unit to record individual supplement intake on d -28. Cows were offered dried distiller's grains for a 27-d acclimation period (mean intake of 0.29 kg of supplement/cow daily) before transition to a commercially available granular mineral supplement containing CTC for 46 d. Supplement was formulated according to label instructions such that a 630 kg cow must consume 113 g/d to receive the label CTC dose (1.1 mg/kg) or 5.2 kg of supplement over 46 d to receive the recommended 32.2 g CTC dose. Feeding and non-feeding events during the 46-d observation period were not randomly distributed ($P < 0.01$), and the mean number of consecutive days a cow did or did not consume mineral supplement were 1.8 and 5.6 days, respectively. As cow age increased, visits to the feeding unit and total supplement consumption decreased ($P < 0.01$). Mean supplement consumption was 40.5 g/cow/d, providing 0.25 g CTC/cow/d, and only 2 of 103 (1.9%) cows consumed enough supplement to receive the recommended dose. Results indicate that providing a granular free-choice supplement containing CTC was not an effective method of ensuring cows consumed an adequate amount of supplement to receive CTC at the label-directed dose and frequency.

U-P13 INTRANASAL INSULIN IMPROVES NEUROBEHAVIORAL PERFORMANCE AND REDUCES BRAIN INJURY FOLLOWING SYSTEMIC LIPOPOLYSACCHARIDE EXPOSURE IN NEONATAL RATS

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Inflammation and oxidative stress play important roles in neonatal brain damage. Previous studies from our lab showed that systemic administration of lipopolysaccharide (LPS) induces brain damage and neurobehavioral dysfunction in neonatal rats, which is associated with the production of pro-inflammatory cytokines and oxidative stress. Recent studies suggest that intranasal insulin treatment could be a neuroprotective agent in adult animals. Therefore, the objective of this study was to determine whether intranasal insulin treatment reduces LPS-induced brain inflammation and brain injury, as well as neurobehavioral dysfunction in neonatal rats. LPS (2 mg/kg) or sterile saline was administered via intraperitoneal (i.p.) injection in postnatal day 5 (P5) Sprague Dawley rat pups, and fluorescence-tagged insulin (Alex-546-insulin)/vehicle, human insulin (25 µg), or vehicle was administered to each nostril 5 min after LPS injection. Sensorimotor behavioral tests were carried out 24 hours (P6) after LPS exposure and brain tissues were collected to determine brain injury and pro-inflammatory cytokine interleukin-1β (IL-1β) levels. Shortly after administration, widespread Alex-546-insulin-binding cells were detected in the brain. ELISA results demonstrated measurable insulin levels in the brain 15 min after insulin administration. Our results showed that intranasal insulin reduced LPS-induced hypothermia, and improved sensorimotor neurobehavioral deficits in P6 rats. Intranasal insulin also reduced LPS-induced brain injury, elevated IL-1β levels and numbers of microglia (Iba1+), suggesting neuroprotection and anti-inflammatory effects. Our study suggests that intranasal insulin affords a broad neuroprotection by targeting multiple signaling pathways including inflammation.

U-P14 THE EFFECT OF A HIGH-INTENSITY FUNCTIONAL TRAINING WARM-UP ON DEADLIFT ONE-REPETITION MAXIMUM PERFORMANCE

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General warm-ups (GWU) are typically done before an individual participates in resistance exercise. Over the years, different warm-ups have been implemented to help individuals prepare for physical activity; however, there is lack of empirical evidence as to which warm-ups fully optimize muscle potential. The purpose of this study was to measure the effects of a traditional (TRAD) GWU and a high-intensity functional training (HIFT) GWU preceding a conventional barbell deadlift one-repetition maximum (1-RM) test, which included measurements of muscular force, power, and velocity, and muscular activity of the biceps femoris, vastus lateralis, and gluteus maximus muscles. In addition, rating of perceived exertion (RPE) and heart rate (HR) were assessed immediately after each GWU. Seven healthy, resistance trained males (Mean ± SD) (21.5±2.1 years) participated in the study. The participants were randomly counterbalanced into the traditional and the HIFT GWU conditions. The TRAD GWU consisted of cycling on a Monark cycle ergometer for 15 minutes at a heart rate between 55-60% of the maximal heart rate. The HIFT GWU consisted of completing the following protocol for as many rounds and repetitions as possible in 15 minutes: 250-meter row on a rowing ergometer, 5 burpees, 10 kettlebell swings (53-pound kettlebell), 15 air squats. There were no significant differences ($p \geq 0.35$ for all) for 1-RM (Mean ± SD) (TRAD: 377.5 ± 67.6 lbs; HIFT: 370.0 ± 67.6 lbs), force (TRAD: 1729.0 ± 356.3 N; HIFT: 2080.3 ± 844.4 N), power (TRAD: 571.1 ± 219.4 W; HIFT: 548.0 ± 247.0 W), velocity (TRAD: 0.39 ± 0.10 m/s; HIFT: 0.38 ± 0.09 m/s), or muscular activity (percentage of MVC) between TRAD and HIFT. There was significantly higher ($p < 0.01$ for both) heart rate (TRAD: 118 ± 6.4 bpm; HIFT: 174.6 ± 18.3 bpm) and RPE (TRAD: 9.4 ± 1.6; HIFT: 15.4 ± 1.7) immediately after both GWU conditions. A TRAD and HIFT GWU produced similar 1-RM, force output, power, velocity, and muscular activity, while the HIFT condition elicited higher exertion and intensity. These results can be utilized in those who perform concurrent aerobic and resistance training in the same session, because our data indicated engaging in high-intensity aerobic activity before a heavy resistance exercise did not negatively affect participant's strength performance. In addition, performing a bout of higher intensity exercise before heavy resistance exercise may be a useful modality order for those who do not engage in regular aerobic exercise, since there may be greater health benefits to engaging in higher intensities of activity.

U-P15 NEUROPEPTIDE Y ANTAGONIST AMELIORATES MATERNAL INFLAMMATION AND REDUCED UTERINE PERFUSION PRESSURE-INDUCED POOR FETAL DEVELOPMENT AND NEUROBEHAVIORAL DEFICITS IN PREGNANT RATS

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Pregnancy is associated with an increase in uterine blood flow contributing to normal fetal development. The increase in vasoconstrictive substance neuropeptide Y (NPY) might be associated with preeclampsia. Experimental studies suggest a link between both maternal inflammation and reduced uterine perfusion pressure (RUPP), and increased NPY levels in pregnant rats may affect fetal development. This study tested whether NPY antagonist treatment reduced maternal inflammation and RUPP-induced poor fetal development and neurobehavioral deficits in pregnant rats. Lipopolysaccharide (LPS) (100 µg/kg) was administered intraperitoneally into pregnant rats on day 13 of gestation (G13) and RUPP surgery was performed on G14. G14 rats were treated with NPY antagonist through subcutaneous micro-osmotic pump infusion at a dose of 5 µg/kg/day for 6 days. Y maze and Plus maze tests were assessed on G13, G16 and G19 followed by euthanasia at G20 to collect placenta and fetal tissue for assessment of fetal development. Our results showed that NPY antagonist treatment reduced maternal inflammation and RUPP-induced short-term memory deficits and anxiety as indicated by Y maze and Plus maze test results, respectively. NPY antagonist treatment also attenuated maternal inflammation and RUPP-induced reduction in fetal weight and placenta weight on G20. These results suggest that antagonization the Y1 receptor may rectify vasoconstriction associated maternal LPS exposure and RUPP-induced neurobehavioral dysfunction in pregnant rats, and normalize placenta and fetal weight. Our model may be useful for studying mechanisms involved in the maternal inflammation and RUPP-induced pregnancy neurobehavioral deficits and poor fetal development, and development of potential therapeutic strategies.

U-P16 CELLULAR EFFECTS OF CATABOLIC INFLAMMATORY CYTOKINES ON CHONDROCYTES

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The inhibitory effects of pro-inflammatory cytokines interleukin 1β, tumor necrosis factor-α, and interleukin-6 on articular chondrocyte growth dynamics are well documented. Previous studies have

shown that IL-1β and TNFα inhibit chondrocyte differentiation and induce cell death. In contrast to bone remodeling, the cartilage remodeling process mediated entirely by chondrocytes. Most importantly, the chondrocyte is responsible not only for the synthesis of the complex extracellular matrix of the articular cartilage, but it is also the source of proteinases and other precursors that degrade the damaged matrix to permit repair. IL-1β and TNFα appear to play important roles in affecting chondrocyte function. Numerous studies have shown that IL-1β stimulates chondrocytes to increase production of matrix metalloproteinases (MMP's) and other degradative products. It hypothesized that IL-1β is extremely important to cartilage destruction, while TNFα appears to drive the inflammatory process. Recent studies demonstrated that other cytokines may be directly or indirectly involved in the inflammatory process of hard tissues. For example, IL-6 has been proposed as a contributor to the pathogenesis of osteoarthritis. The objective of this study was to evaluate matrix degradation markers, apoptosis, cellular damage markers, and cellular morphology of chondrocytes following a challenge with inflammatory cytokines and how this impacts clinical healing and tissue regeneration.

U-P17 MAPPING INVASIVE AQUATIC PLANTS USING UAS IMAGERY AND DEEP LEARNING

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Invasive aquatic plants (IAP) are problematic in every part of the world because they endanger native plants and ruin biodiversity. Mapping where they grow is important, so that preventive measures can be put in place. Mapping of IAPs has evolved drastically throughout the last two decades. From on-foot surveys to satellite imagery, there are numerous ways to map IAPs. In this study, we will be using images collected from a UAS (Uncrewed Aerial System) with a hyperspectral sensor because of its high spatial and spectral resolution. The images are of eight distinct plants, which include alligator weed, Cuban bulrush, giant salvinia, primrose, torpedo grass, water hyacinth, water lettuce, and water lily. Remotely sensed images will be combined with deep learning models for segmentation and classification to understand the most efficient method. The deep learning models that will be studied are Mask R-CNN (Region Based Convolutional Neural Network) and SpineNet because of their strong feature extraction abilities. Mask R-CNN is a popular type of Convolutional Neural Network (CNN) that excels in high-quality image segmentation. On the other hand, SpineNet is CNN backbone that aims to retain spatial information in an image. The two models will then be trained on the images to learn features of each plant.

U-P18 GEOSPATIAL ANALYSIS: DISPERSAL OF ASPERGILLUS FLAVUS AF36 STRAIN IN TREE NUT CROPPING SYSTEMS

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This research project conducted an exploratory geospatial analysis to examine the dispersal patterns of the biocontrol *Aspergillus Flavus* (*A. flavus*) strain AF36 in tree nut cropping systems in southeastern Arizona. AF36 is a non-aflatoxigenic *A. flavus* strain that is used to treat crops to control the aflatoxin producing *A. flavus* strains and reduce aflatoxin contamination. The objective of this project was to develop geospatial analysis script programs using Python geospatial data science packages to discover and visualize the changes in the frequencies of the AF36 strain from treated tree nut crops to non-treated crops and across the landscape over a two-year period. Data for percent AF36 in georeferenced soil samples from a survey of AF36 treated and non-treated fields in southeastern Arizona were provided by USDA-ARS. From the original data, geospatial analysis was conducted with tools such as Jupyter Notebook to formulate astute graphics in terms of statistical comparison and geographical study through different conditions enabled through the data collection. These conditions include examining various kinds of crops and surrounding areas, two years of data collection, and measurements provided before and after the application of AF36. Insights gained through this research analysis will contribute to the development of strategies to mitigate aflatoxin contamination risks, leading to improved tree nut production and economic viability in the industry.

U-P19 INVESTIGATING THE INFLUENCE OF RAINFALL AND OTHER WEATHER-FORCING FACTORS ON SOIL MOISTURE AND SOYBEAN YIELD USING THE APEX MODEL

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This research aims to investigate the influence of rainfall and other weather factors on soil moisture and soybean yield using the APEX (Agricultural Policy/Environmental eXtender) model. To conduct the study, the APEX model was implemented by utilizing various databases, including soil, weather, crop, field management, and spatial location data. The Gridded Soil Survey Geographic Soil Map (gSSURGO-30) from the USDA Natural Resources Conservation Service (NRCS) and the Gridded Cropland data layer (CDL-30m) from the USDA National Agricultural Statistics Service (NASS) was specifically used. These data layers were overlaid and clipped in ArcGIS (ESRI, Redlands, CA) to define the area of interest. The APEX model was then implemented to simulate crop yield and soil moisture content for each 30m * 30m resolution Soybeans' grid of the Cropland data layer over a period of approximately 43 years. The APEX model provided outputs of soybean yield and soil moisture content at different scales and depths, providing insights into immediate water availability for plant growth. Additionally, this study analyzed soil moisture fluctuations by aggregating soil moisture data to soybean's vegetative and reproductive stages, thus assessing their impact on soybean yield during those stages. Furthermore, the research aims to estimate soybean yield based on the planted acreage of soybeans. By combining the findings related to weather factors, soil moisture, and crop yield, the study seeks to enhance our understanding of the relationships between these variables and their impact on soybean production.

U-P20 ENHANCING HERBICIDE SELECTIVITY IN TOMATO THROUGH SAFENING EFFECTS OF MELATONIN AND 2,4,6-TRICHLOROPHENOXYACETIC ACID

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Safeners are compounds used to protect crops by enhancing their tolerance to herbicides through metabolic pathways. This study aimed to investigate the biochemical effects of melatonin and 2,4,6-trichlorophenoxyacetic acid (2,4,6-T) safeners in tomato cultivation. The experiment followed a randomized factorial design, evaluating four herbicides (dicamba, 2,4-D, metribuzin, sulfentrazone) and an untreated control, along with three safener treatments (melatonin, 2,4,6-T, control). Visual injury assessments were conducted at multiple time points, and biomass measurements were taken at 21 days after application (DAA). Glutathione S-transferase (GST) activity, a key detoxifying enzyme, was evaluated at different time intervals. Results indicated that pre-treating seeds with safeners significantly reduced injury, increased biomass, and enhanced GST enzymatic activity in tomato plants exposed to herbicides. These findings contribute to our understanding of plant defense mechanisms and demonstrate the potential of safeners to improve herbicide selectivity in tomato crops. Such knowledge can aid in the development of more effective weed management strategies for sustainable agriculture.

U-P21 AGOMELATINE ATTENUATES SYSTEMIC LIPOPOLYSACCHARIDE-INDUCED BRAIN INJURY, BRAIN INFLAMMATION, AND NEUROBEHAVIORAL DISTURBANCES IN NEONATAL RATS

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Inflammation and oxidative stress play important roles in brain injury in neonatal human and animal models. Our previous studies showed that systemic administration of endotoxin lipopolysaccharide (LPS) induces brain damage and neurobehavioral dysfunction in neonatal rats, which is associated with the production of pro-inflammatory cytokines and oxidative stress. Recent studies suggest that agomelatine treatment which could affect inflammation and microglia polarization could be a neuroprotective agent in adult animals. The objective of the current study was to determine whether agomelatine, a melatonergic agonist with anti-inflammatory and antioxidative effects, ameliorates LPS-induced brain inflammation and neurobehavioral dysfunction in neonatal rats. Intraperitoneal (i.p.) injections of LPS (2 mg/kg) were performed in P5 Sprague Dawley rat pups and agomelatine (20 mg/kg) or vehicle was administered (i.p.) 5 min after LPS injection. Control rats were injected (i.p.) with sterile saline. Neurobehavioral tests were performed and brain inflammation was examined on P6, 24 hours after LPS exposure. Our results showed that agomelatine reduced LPS-induced sensorimotor disturbances and reduction in pre-social interaction (ultrasonic vocalization) at P6. Agomelatine also reduced LPS-induced brain injury, increase in IL-1β levels and thiobarbituric acid reactive substances (TBARS) contents, which suggests anti-inflammatory and antioxidative effects. These results indicated that agomelatine may provide protection against systemic LPS exposure-induced brain inflammation, lipid peroxidation and neurobehavioral disturbances, which are associated with agomelatine's ability to attenuate LPS-induced inflammation and oxidative stress.

U-P22 REPLICATION OF IMPACT PARAMETERS FROM CADAVERIC LUMBAR INTERBODY FUSION USING A BENCHTOP DEVICE

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Transforaminal lumbar interbody fusion (TLIF), the insertion of an interbody fusion device (IFD) between vertebrae of the lumbar spine, is performed to relieve lower back pain caused by disc pathologies. The IFD is inserted in the disc space via malleting of an insertion tool, a process which can damage the IFD. Cadavers are traditionally used for insertion testing of IFDs, but cadavers involve intensive preparation, are not readily available, and are inherently variable. Thus, benchtop devices are needed to provide reproducible experimental conditions that mimic cadaveric experiments. In this research, a drop weight benchtop device was constructed, outfitted with sensors, and used to measure four key impact parameters during impaction of the insertion tool: (i) slope of the impact wave, (ii) peak force, (iii) area under the curve, and (iv) impact duration. Cadaveric data was collected using the TLIF procedure to validate the results of the benchtop device. Upon comparison of cadaveric and benchtop device data, modifications were made to the benchtop device to better mimic cadaveric testing in these four key parameters. Following these changes, further testing of the TLIF procedure was completed with the benchtop. Currently, the objective is to complete benchtop testing of the anterior lumbar interbody fusion (ALIF) procedure and compare to recent ALIF cadaveric data. Additionally, the impact of friction on drop weight velocity is being investigated. The long-term goal of this research is to ultimately replace cadaveric experiments for lumbar interbody fusion procedures with a robust and versatile benchtop device.

U-P23 SYNTHESIS OF PYRIDINE-BASED HIV INTEGRASE INHIBITORS

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Retroviruses employ three unique enzymes, reverse transcriptase, integrase and protease, that are essential for their life cycle. Antiviral therapy targets those enzymes preferably, as less side effects are expected. Human immunodeficiency virus (HIV), which causes acquired immunodeficiency syndrome (AIDS), is generally combated with triple therapy, consisting of usually two reverse transcriptase inhibitors and one integrase or protease inhibitor. As the high mutation rate of the virus causes resistance, HIV drugs are constantly optimized. HIV integrase incorporates the viral DNA into the host cell genome. HIV Integrase inhibitors are mostly based on aromatic heterocycles such as pyridine and quinoline. In this project, we are constructing the pyridine core by reaction of substituted malonic esters with an aminocrotonate ester. The development of the side chain in the 3-position which consists of a methine carbon carrying a tert-butoxy group and a carboxylic acid, is essential. This requires the extension by one carbon, which we accomplish by a Bode homologation reaction. Here we present our new results in cleaving the Bode compound with various oxidizing agents. Further incorporation of substituents on the pyridine core will determine the efficiency of the inhibitors.

U-P24 PHOTOCHEMICAL KEY STEPS IN CYCLIZATION REACTIONS: SYNTHESIS OF ISOINDOLONE PIPERIDINES AS KINASE INHIBITORS

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Cancer cells are the result of disruption of tightly regulated metabolic pathways. This leads to uncontrolled proliferation of cells as seen in invasive tumors. Inhibition of certain metabolic enzymes thus might provide a tool to minimize the harmful effects of excessive cell growth. Two key phosphorylating enzymes, glycogen synthase kinase-3 (GSK3) and cyclin-dependent kinases (CDKs) are the target of researchers to interfere with cancer metabolism. Valmerins are isoindolone piperidines that have been shown to inhibit GSK3/CDK enzymes during cell proliferation. In this project, we are using the photodecarboxylative cyclization as a key step in the synthesis of GSK3/CDK inhibitors. The syntheses are initiated from affordable building blocks and culminate in the stereo-controlled synthesis of the target molecules. Variations in the chromophore lead to the formation of regioisomers, the control of which is important.

GRADUATE STUDENT POSTER (G-P)

G-P25 DESIGN OF UAV SIMULATIONS VIA PHYSICS-BASED SIMULATION FOR SITUATIONAL AWARENESS

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The use of unmanned aerial vehicles (UAVs) has been widely used in multiple applications including homeland security, transportation, and agriculture. To demonstrate the behavior of UAVs, high-fidelity simulations have been highly prevalent and becoming more popular every year. Situational awareness is reliant on pilot interaction and are critical to aircraft safety when encountering an intruder aircraft. We will develop a Physics-based simulation (PBS) that can validate UAVs' detection capability and coverage of abnormal situations while being simulated in real-time with a visualization component. Bayesian Belief Networks (BBN) will be used to incorporate environmental uncertainties and different agents' behaviors in multiple scenarios. The authors will start implementing a Bayesian network and extending it to BBN to generate UAV trajectories within the confidence interval. Moreover, we will build upon these models with visual acquisition and human performance. The proposed PBS simulation will be visualized using the game engine called Unreal Engine. This stability of the proposed approach will be validated via these simulations.

G-P26 TOPOGRAPHY OF A FRACTURED MONOLITHIC ZIRCONIA CROWN - A CASE REPORT

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We aimed to evaluate the topography and surface roughness of a fractured implant-retained monolithic zirconia crown using a versatile non-contact 3D surface profiler that combines features of an optical microscope, laser profilometer, and scanning electron microscope. A cleaned, epoxy-replicated crown obtained from the faculty dentist was divided into three thirds: occlusal, middle, and cervical for detailed profiling using a 3D surface profiler (VK-X3000, Keyence, USA). Surface roughness values were then statistically analyzed using one-way ANOVA repeated measurements. The facial surface roughness showed insignificant differences among its regions ($p=0.39$). The lingual surface was similar to the facial surface, except for the distal cervical aspect, which had the highest roughness (16.98 ± 3.9 µm, $p=0.02$). The mesial and distal surfaces showed varying roughness values. The lowest roughness was found in the mesial surface's middle third (7.18 ± 2.22 µm, $p=0.01$), while the highest roughness was in the distal surface's occlusal third (23.07 ± 5.3 µm, $p=0.04$). The occlusal surface's central groove significantly differed in roughness from the occlusal planes ($p=0.04$). The roughest areas correlated to regions left unpolished after adjustments with diamond burs. A 3D surface profiler provided a comprehensive evaluation of a zirconia crown's surface roughness, revealing significant variation across the crown. Notably, high roughness values were observed in the lingual surface's distal cervical aspect, the distal surface's occlusal third, and occlusal planes. These rough regions were often unpolished areas, emphasizing the importance of comprehensive polishing in maintaining the integrity of zirconia restorations.

G-P27 EFFECTIVENESS OF OMEKA VIRTUAL COLLECTIONS FOR ENGAGING DUNN-SEILER MUSEUM AUDIENCES

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Museums have been an important part of human history for centuries because of their preservation of important artifacts and cultural relics. Traditionally, visitors had to travel to the museum to view artifacts and specimens in a gallery. Lack of museum access has been a continuing issue for low-income visitors, and it became a problem for all during the Covid-19 pandemic. The creation of virtual museum collections, including website collections like the Omeka Virtual Platform, allow scientists to share museum collections with a larger audience because visitors are constrained by financial or geographic barriers. This study investigated the effectiveness of the Dunn-Seiler Museum's Omeka Virtual Platform for learning outcomes. The Dunn-Seiler hosts a small public gallery in the Department of Geosciences at Mississippi State University. We researched how virtual museum platforms compared with in-person informal outreach with respect to learners' content gains and affective responses to activities that investigated fossil specimens (virtually and hands-on) that demonstrated both higher and lower sea levels in Mississippi's geologic history. The research was conducted in middle-level classrooms within two school districts in Mississippi ($N = 99$ students). Analysis of pre- and post-assessments of control (hands-on) and experimental (virtual specimens) groups revealed that there was no significant difference in content gain or affective response when student data were reviewed in aggregate for control vs. experimental groups. These results suggest that virtual fossil specimens offer a comparable experience to hands-on specimens within museum outreach.

G-P28 CAN BIOSTIMULANTS IMPROVE SOYBEAN GERMINATION UNDER LOW AND HIGH TEMPERATURES?

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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. A total of nine treatments were tested to evaluate the influence of biostimulants under 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. Time to 90% germination decreased by 1 h at 35 °C (BioWake), 2 h at 25 °C (Fertiactyl+Biofriendly), and 3.30 h at 15 °C BioSa +Biofriendly +polymer). Seeds treated with BioSa+Biofriendly, and BioSa+Biofriendly+polymer increased seedling dry weight by 19% at 35 °C, and 15% at 15 °C, respectively. These findings suggest that 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.

G-P29 DATA-DRIVEN EVACUATION MODELING FOR SPATIAL DIFFERENCES WITH AGENT-BASED SIMULATIONS

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Predicting evacuation numbers during the approach of a natural disaster is difficult, as different regions throughout the world have varying preparation and departure attitudes. A model must be

constructed that accounts for the consequences of decisions such as transportation mode, evacuation timing, and destination decision. However, due to the unpredictable nature of disasters, information gathered from preemptive questionnaires will have increasing uncertainty over time. Furthermore, these studies often focus on metropolitan areas, so geographical and demographic differences should be compared with those living in smaller urban, suburban, and rural areas. While the sharing of evacuation protocol internationally would be unreliable, cooperation between states or counties could provide life-saving benefits. This work proposes a data comparison of hurricane evacuation behaviors for metro areas bordering the Gulf of Mexico with each other using agent-based simulations suited to their respective populations. The proposed simulation incorporates the previous hurricane experiences, household factors, authoritative actions, storm characteristics, and strength of community bond to simulate individuals' evacuation preferences. Specific studies of Hurricane Harvey (2017) in Houston, Texas; Hurricane Irma (2017) in Miami, Florida; and Hurricane Ida (2021) in Gulfport, Mississippi are considered using the ODD framework (overview, design, and details) to provide the comprehensive and exclusive understanding of the evacuation behaviors. The simulation is validated through a GIS map projection accounting for route choice, roadway traffic, and departure timing.

G-P30 AN EVALUATION OF CURRENT STATUS OF GLACIERS IN THE WESTERN UNITED STATES USING MACHINE LEARNING ALGORITHMS AND SENTINEL-2A IMAGES

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We utilized random forest machine learning classification to assess the current status of glaciers in the western United States using Sentinel-2A satellite images. The GLIMS and RGI glacier databases provided baseline data for studying regional climate change impacts. The RGI database compiled information on 5021 glaciers in the western US based on topographic maps created from aerial photos taken between 1943 and 1987, published by the US Geological Survey (USGS) and US Forest Service (USFS). By analyzing Sentinel-2A imagery from September 2020 and comparing it to the RGI inventory, the study determined the current conditions of the glaciers. The random forest classification achieved over 98 percent accuracy. The findings revealed a significant decrease in glacier area and volume in the western United States. Presently, there are 4104 glaciers across seven states, covering a total area of 432.05 km^2 with a corresponding volume of 22.23 km^3. The study period witnessed a loss of 237.04 km^2 in glacier area, accounting for a 35.43% reduction compared to the RGI boundaries. The volume lost during this period amounts to 14.45 km^3, ~13 km^3 water equivalent. Washington experienced the most substantial glacier area loss(130.06km^2). For example, the glaciers in the Mt. Baker and Mt. Shuksan in the North Cascade Range, Washington, on an average only 85% of the original glacier boundary is covered with the ice/snow at the end of the 2020 hydrological year. Glaciers such as West Nooksack and Hanging glaciers have lost more than 50 percent of their area. The study will provide a complete list of glaciers in the Western US with their current ice/snow area and the measure of volume.

G-P31 DECODING GENOTYPIC VARIABILITY IN ROMAINE LETTUCE FOR IMPROVED SALT STRESS RESILIENCE

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Lettuce is a cool-season green and widely consumed leafy salad, and it is a highly adopted crop in the hydroponic system regarding crop proportion and producers in the States. However, the three-fold increase in water allocation and limited availability of salt-free fresh water makes growers challenging to harness the productive potential of lettuce in hydroponic systems. The electrical conductivity level above 2.0 dS/m makes the solution salty, affecting the continuous supply of essential nutrients required for adequate lettuce growth and development. Despite the mounting evidence supporting salt stress-induced changes in yield and quality losses, the comprehensive studies on romaine lettuce salt stress tolerance are limited. Multiple experiments were carried out in both a growth chamber and greenhouse environments using 2-38 lettuce genotypes to investigate the impact of salt stress during the late rosette and early head formation stages. Exposure of lettuce to four different levels of NaCl (0, 50, 100, and 150 mM) affected the plant's growth and nutrition. A positive association between salt treatment and the sodium-to-potassium ion ratio was observed at both stages. Higher NaCl (150 mM) led to a 76% reduction in fresh mass during both stages, but carbon assimilation remained unchanged despite reduced stomatal conductance. Further, 38 lettuce genotypes were exposed to 100 mM NaCl to identify slat stress-tolerant genotypes. The results displayed that the response of lettuce to salt stress varied depending on the genotype. PI 212099, Buttercrunch-1, and PI 171676 were found to be highly salt-tolerant. Results demonstrated that the Green forest was more sensitive to salt stress, exhibiting a higher decline in biomass than Burgundy delight (Tolerant). Both genotypes had higher levels of sodium accumulation under salt stress, while potassium levels decreased in the Green forest but remained stable in Burgundy Delight. Salt stress reduced gas exchange rates in both genotypes, the highest reduction was observed in the sensitive genotype. Chlorophyll A levels increased under salt stress in both genotypes, while carotenoid pigments and chlorophyll B remained unaffected. Fructose levels showed variable responses, increasing initially and then declining in some cases, while glucose levels decreased in Green Forest but increased in Burgundy Delight. Phenolic increased with increases in stress duration in both genotypes, with higher levels observed in Burgundy Delight. Flavonoid concentration was consistently higher in Burgundy Delight regardless of salt treatment. The results indicated that the superior performance of Burgundy Delight under salt stress might be attributed to its ability to regulate ion transport, maintain osmotic balance through sugar accumulation, and enhance antioxidant defense systems.

G-P32 MI-AFR: MULTIPLE INSTANCE ACTIVE LEARNING-BASED APPROACH FOR FISH SPECIES RECOGNITION IN UNDERWATER ENVIRONMENTS

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Video surveys are commonly used to monitor the abundance and distribution of managed species to support management. However, considerable effort, time, and cost are required for human review and automated fish species recognition provides an effective solution to remove the bottleneck of post-processing. Implementing fish species detection techniques for underwater imagery is a challenging task. In this work, we present the Multiple Instance Active-learning for Fish-species Recognition (MI-AFR), which is formulated as an object detection-based approach to perform localization and classification of fish species. It can select the most informative fish images from unlabeled sets by estimating the uncertainty of unlabeled images by using adversarial classifiers trained on labeled sets. Enhanced performance of MI-AFR is obtained by combining the uncertainties with random sampling-based technique. Moreover, we have analyzed the improved performance of MI-AFR by considering different backbone networks as a trade-off between speed and accuracy. For experiments, we have used the fine-grained and large-scale reef fish dataset obtained from the Gulf of Mexico " the Southeast Area Monitoring and Assessment Program Dataset 2021 (SEAMAPD21). The experimental results illustrate that the superiority of the proposed method can establish a solid foundation for active learning

in fish species recognition, especially with a small number of labeled sets.

G-P33 MORE THAN DETOXIFICATION: A GLUCOSE-CONJUGATING ENZYME IS HIGHLY EXPRESSED IN THE SILK GLANDS OF MOTHS

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The corn earworm (*Helicoverpa zea*) is a serious agricultural pest species that feasts on several economically important plants. Recently, a genomic analysis of the corn earworm identified 45 different UGT genes. Uridine diphosphate glycosyltransferase (UGT) is a multigene family of enzymes responsible for catalyzing glycosylation of small hydrophobic molecules. These enzymes participate in the detoxification of xenobiotics and biotransformation of endobiotics, where glucose conjugation increases the water solubility of lipophilic aglycone compounds. Quantitative and real-time PCR were used to analyze the expression levels of UGT34 in different larval instar stages and silk gland sub-segments, revealing that UGT34 is generally expressed at all larval instar levels and largely expressed in the middle and posterior subsegments of the silk glands. The soybean looper (*Chrysodeixis includens*), another noctuid moth species, was analyzed and found to have similar gene expression patterns, implying that UGT34 may play an important role in the silk glands of moths. To determine UGT34 function RNA interference (RNAi) was used, but it revealed to be unsuccessful. Altogether, the present study implies that UGT34 plays an important role in silk glands, but its molecular and physiological function remains unknown. Further investigation is required on the novel role of the sugar conjugating enzyme in relation to silk production and other functions in caterpillars.

G-P34 TRENDS IN PREVALENCE OF DEPRESSIVE SYMPTOMS AND SUICIDAL TENDENCIES AMONG US ADOLESCENTS AND PROJECTIONS TO 2031; YOUTH RISK BEHAVIOR SERVEILLENCE SYSTEM: 2001-2021

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Transient turbulent phases of physiological and psychosocial changes left adolescents vulnerable to psychological disorders like depression, fourth leading cause of global disability. Suicide is the second leading cause of death among US adolescents. Overlooking depressive symptoms in adolescents' increases suicide rates. The aim of the study is to estimate the prevalence of depressive symptoms and suicidal tendencies among US adolescents over time and projections through 2031, since no such data is available. Data from Youth Risk Behavior Surveillance System by CDC were extracted and analyzed from 2001 to 2021 using SPSS complex sample module and Microsoft excel. Depressive symptoms and suicidal tendency were assessed from survey questions "sad or hopeless", "considered suicide", "made a suicide plan" and "attempted suicide". Logistic regression analysis was performed to establish the associations of depressive symptoms, suicidal tendency and sex. Robust method expert modeler of time series modeler is used for future projections. A total of 161,445 adolescents are included from 2001 to 2021 for trend analysis. Overall prevalence of depressive symptoms was 30.8% and suicidal tendencies (considered suicide, made suicide plan and attempted suicide) were 17.2%, 14%, and 8.6% respectively. If the uptrend continues like the past two decades, the corresponding prevalence is expected to reach 70%, 36%, 24%, and 10.7% in 2031. By findings, females are in most vulnerable state (OR=3.3; 95%CI:3-3.6). Health policies, future research, and mitigation supports should be gender-specific and focused to curb depressive symptoms and suicidal tendency among adolescents to prevent a future epidemic.

G-P35 Evaluating Cover Crops and N Fertilization Effects on Soil Microbiota, Soil Enzymatic Activities and Nutrient Cycling in Corn Production Systems

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The composition and functioning of soil microbiota, including nutrient cycling exhibit variations in response to different soil management approaches within agroecosystems.Incorporating cover crops (CC) into cropping systems, as a means of intensification and diversification, has been shown to enhance microbial abundance and promote soil enzymatic activities. A three-year study with strip plot design in two locations (Starkville and Newton)proposed to assess various CC's (ryegrass, balansa, red clover, radish, and CC mixes) and Nlevels (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 (r2 = 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.

G-P36 IDENTIFICATION OF MICROBIALLY SPOILED BROILER BREAST MEAT THROUGH OPTICAL SENSING AND DEEP LEARNING

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Globally, broiler breast meats are highly demanded by consumers. However, broiler breast meats are susceptible to deterioration and spoilage. Manual approaches, such as visual inspection and organoleptic, are common practices in commercial processing plants to evaluate meat samples. These approaches are subjective to human assessment error, laborious, and time-consuming. Therefore, this study aims to use a novel optical technology under structured illumination reflectance imaging (SIRI) with deep learning to differentiate the fresh and spoiled meats. The imagery data of broiler breast meat was acquired using SIRI with spatial frequencies ranging from 0.05 to 0.40 cycles mm^{-1} to obtain three-phase pattern images. The pattern images were then demodulated to generate direct component (DC; 0 cycles mm^{-1}) and amplitude component (AC) images. Three pre-trained deep learning models (i.e., VGG16, EfficientNetB6, and ResNeXt101) were utilized to extract high-level features from the AC and DC images. Principal component analysis (PCA) was implemented to reduce feature redundancy. Thereafter, the selected features were used to develop the binary classifiers of linear discriminant analysis (LDA) and support vector machine (SVM) to classify the meat samples into fresh or spoiled. Finally, SVM outperformed LDA with the accuracies of 64.8%, 66.4%, and 69.6% achieved with DC images, and 68.4% (0.20 cycles mm^{-1}), 72% (0.25 cycles mm^{-1}), and 76% (0.25 cycles mm^{-1}) with AC images using VGG16, EfficientNetB6, and ResNeXt101, respectively. The results demonstrated that the proposed optical sensing technology of SIRI is promising in identifying the microbially spoiled broiler breast meat.

G-P37 EFFECTS OF DIETARY SUPPLEMENTATION OF MHA-CA VS. DL-MET ON GROWTH PERFORMANCE AND INTESTINAL HISTOMORPHOLOGY IN GROWING PIGS

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This study focuses on exploring two forms of Methionine (Met) on growth performance and intestinal integrity in oxidatively stressed 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. Group 4 received an MHA-Ca supplemented diet (D3) in which the MHA-Ca quantity was 1.54 x DL-Met in D2. After 3 weeks of feeding (phase 1), pigs were injected with either 10 mL saline (for Group 1) or 10 mg/kg-BW diquat in 10 mL saline (for Groups 2, 3 and 4). By the end of Phases 1 and 2, ADG, ADFI, and G:F were determined, respectively. By the end of Phase 2, pigs were euthanized, and histomorphometric analysis was conducted on ileum samples for villus height (VH), villus width (VW), crypt depth (CD), VH:CD ratio (VCR), and numbers of goblet cells (GC). At phase 1, G:F was lowered ($P<0.05$) in Group 4 relative to Group 3. At phase 2, in terms of performance, ADFI and ADG were reduced ($P<0.05$) in Group 2 relative to Group 1. In terms of intestinal morphology, CD was reduced in Group 2 relative to Group 1, VH and CD were elongated ($P<0.05$) with more DL-Met, VW and CD reduced in Group 4 relative to Group 3. In conclusion, DL-Met is more potent than MHA-Ca in mitigating the intestinal oxidative damage, but the two forms of Met have similar effect on performance.

G-P38 IMPACT OF PRUNING INTENSITY AND VINE SPACING ON YIELD AND GRAPE QUALITY OF 'MIDSOUTH' IN SOUTH MISSISSIPPI

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'MidSouth' bunch grapes face limitations as varietal red wine grapes due to low soluble solids and high acidity. Additionally, there is potential that improper pruning reduced fruit quantity in past studies. However, improved vine management could improve both fruit quantity and quality. A study conducted in McNeill, MS explored pruning treatments and spacing for 'MidSouth' vines in 2022 and 2023. Vines received minimal pruning, cane pruning to 60 buds, spur pruning to 120 buds, or spur pruning to 60 buds (control) and were spaced 1.5m or 2.7m. Minimally pruned vines had higher yields, clusters per vine, and berries per cluster but lower pruning weight, berry weight, soluble solids, and juice pH than the control. Cane pruning reduced berry weight and juice pH, while 120 bud spur pruning increased berries per cluster, cluster weight, and yields but decreased berry weight and juice pH. Cane pruning and 120 bud spur pruning did not significantly differ. Vines spaced at 2.7m had higher pruning weight, clusters per vine, and yield per vine but lower berry weight than 1.5m spacing. In 2023, post-pruning measurements of phenological stage, stomatal conductance, transpiration, and chlorophyll fluorescence were taken. Cane-pruned vines exhibited lower chlorophyll fluorescence than 120 bud spur-pruned vines, while minimal pruning and control vines showed no significant difference. Vines spaced at 2.7m had higher stomatal conductance and transpiration but slower phenological stage than 1.5m spacing. Growers should consider 120 bud spur pruning on vines spaced 2.7m to enhance fruit quantity while maintaining quality in 'MidSouth'.

G-P39 MODELING THE EFFECT OF NEIGHBORHOOD COMPETITION ON TREE DIAMETER GROWTH IN THE PACIFIC NORTHWEST COAST RANGE

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Trees compete for various resources such as sunlight, water, and nutrients, which can be expressed as numerical terms, called competition indices (CI). Competition between individual trees is correlated with their growth and mortality. Therefore, CIs are used as independent variables to develop, improve and modify growth and yield models. This study was conducted to test the effect of neighborhood competition on tree diameter growth among Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), western hemlock (*Tsuga heterophylla* (Raf.) Sarg) and red alder (*Alnus rubra* Bong.), in the Pacific Northwest Coast Range, USA. After testing seven distance-independent CIs and three distance-dependent CIs, only the distance-independent CIs were found to significantly affect the diameter growth model. Among them, CIs with basal area and diameter information were the most impactful. As a result, a simple CI was very effective in a model that accounts for the basal area information of different tree species.

G-P40 **EFFECT OF X-RAY IRRADIATION ON Loropetalum GALL BACTERIA**

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Loropetalum, *Loropetalum chinense* (R. Br.) Oliv., is a popular landscape plant, but it can be infected by the gram-negative bacteria *Pseudomonas amygdali* pv *loropetali* pv. nov. Bacterial diseases are difficult to control, and these particular bacteria usually leads to disposal of the plant, resulting in economic losses for the nursery. These bacteria are causing galls on loropetalum which can cause stem girdling leading to reduced growth and possibly death of the plant. The bacteria will infect the plant if it can permeate through a cut or wound in the bark. This creates a major avenue for disease transmission when propagating from cuttings if cuttings are taken from infected plants. With growing public concerns on chemical pesticides and their residues, irradiation is becoming a viable alternative and an effective nonchemical treatment for the control of several pathogens. Studies have shown successful results when gamma irradiation was applied to *Pseudomonas* spp., therefore we hypothesize that radiation could eliminate *P. amygdali* pv *loropetali* pv. nov. on loropetalum stock plants. Bacteria were subjected to six levels of x-ray irradiation 0, 0.5, 1, 1.5, 2, 2.5 kGy (0, 500, 1000, 1500, 2000, 2500 Gy). Initial results showed that x-ray treatment to pure bacteria strains resulted in significant bacterial reduction at all levels, with complete inactivity being observed in the 1.5, 2, and 2.5 kGy (1500, 2000, and 2500 Gy) treatments. With these findings, further studies are being conducted to determine the application of radiation's ability to clean up infected loropetalum plant material.

G-P41 THE IMPACT FACTORS ON THE CHANGES OF GREENHOUSE GAS (GHG) FLUX IN CONSERVATION RESERVE PROGRAM (CRP) HARDWOOD FOREST

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Soil carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are the primary greenhouse gases in forest ecosystems. The GHG fluxes are strongly influenced by abiotic and biotic factors. We used the static chamber method to investigate these three gases from Conservation Reserve Program (CRP) hardwood forests within variable ages in the southeastern US. This study will determine the magnitude of CO_2, N_2O, and CH_4 gas fluxes in the forest soil, present the variation in GHG flux at season pattern, examine the impact of multiple factors on greenhouse gas fluxes across a gradient of sites varying in soil properties (temperature, moisture, PH, bulk density), plantation age, leaf area index (LAI), dominant tree species, and climate characteristics (air temperature and moisture). ANOVA, Pearson correlation coefficients, and Principal Component Analysis (PCA) will be conducted to determine the

main parameters influencing the GHG fluxes. This research will contribute to understanding the role of the forest ecosystem on climate change in the southeastern US.

G-P42 INCORPORATION OF CELLULOSE NANOCRYSTALS INTO A COTTONSEED OIL-BASED NETWORK POLYMER: INVESTIGATION OF THE EFFECT ON MECHANICAL PROPERTIES

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The detrimental issues surrounding global accumulation of traditional plastic waste are well known. Previous decades of research have established the potential for plant oil-based polymers to be a viable replacement for petroleum-derived plastics since these polymers have the potential to biodegrade, therefore, would aid in inhibiting further plastic waste accumulation. Cottonseed oil is one such renewable plant oil that is produced in abundance worldwide, making it a good option for use as a starting monomer in polymerizations. In this work, a network polymer was synthesized from epoxidized cottonseed oil crosslinked with maleic anhydride. This polymer was further modified through the incorporation of cellulose nanocrystals (CNC) in varying mass fractions. The incorporation of CNCs in the network was confirmed by using FTIR. CNC significantly alters the mechanical properties of the crosslinked polymer, with an improvement in mechanical properties, including an increase of elastic moduli (Young's Modulus) and ultimate tensile strength. The polymer's thermal properties have not undergone significant changes for the CNC concentrations considered here, as investigated by thermodynamic analysis and differential scanning calorimetry.

G-P43 NANO- AND MACRO-SCALE IMPACT FAILURE OF POLY(METHYL METHACRYLATE)

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Polymer glasses, such as poly(methyl methacrylate) (PMMA), are often used in impact mitigation applications where impact-resistance, optical transparency and light-weighting are required. However, our understanding regarding the failure behavior of these materials subjected to high-velocity projectile impact from the nanoscale up to macroscale is limited. In this contribution, we study the projectile impact performance of PMMA using two different projectile impact tests. For nanoscale studies, laser-induced projectile impact testing (LIPIT) was employed to investigate the impact performance of thin PMMA films, on the order of a few hundred nanometers in thickness, at strain rates of ~10^5 to 10^7 1/s. For macroscale studies, PMMA sheets with thicknesses on the order to 10 mm were subjected to ballistic and hypervelocity impacts in the strain-rate regime of ~10^6 1/s. By relating the minimum perforation velocity, defined as the minimum impact velocity a material can withstand without catastrophic failure, to specimen geometry and projectile size at these two distinct sizes, we demonstrate how the size scale of the materials system defines the mechanisms of failure and its impact resistance.

G-P44 UNDERWATER FISH SPECIES RECOGNITION WITH AN ENHANCED YOLO MODEL

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Fish species recognition plays a crucial role in various applications such as stock assessments, ecosystem inspection, production management, and species protection, particularly in underwater environments. However, developing effective fish species detection algorithms in such environments is challenging. In this study, we propose the utilization of the YOLOv5 model for fish species recognition, employing it as an object detection model to analyze multiple fish in a single image. We further enhance the model's performance by adjusting the depth scale of different layers in the YOLOv5 backbone, incorporating a transformer block, and introducing a class balance loss function. This approach enables the model to not only localize fish and estimate their positions and sizes but also classify each fish species individually. We evaluate our method on a fine-grained and large-scale reef fish dataset, specifically, the Southeast Area Monitoring and Assessment Program Dataset 2021 (SEAMAPD21) obtained from the Gulf of Mexico. YOLOv5 is a single-stage network architecture designed to address both classification and localization tasks simultaneously. In the case of YOLOv5-l (large), the backbone network comprises convolutional layers with cross-stage partial (CSP) connections. The backbone network extracts essential image features, which are then passed on to the Neck component. The Neck module combines and blends the extracted image features from different layers, creating a rich representation that can be utilized for prediction purposes. The results demonstrate that our enhanced YOLOv5 achieves an $mAP_{0.5}$ (mean Average Precision) of 85.2% and $mAP_{0.5-0.95}$ of 56.6% with 61.30M parameters.

G-P45 AZITHROMYCIN ALLEVIATES BRAIN INFLAMMATION AND IMPROVES SENSORIMOTOR PERFORMANCE FOLLOWING HYPOXIC-ISCHEMIC EXPOSURE IN NEONATAL RATS

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Hypoxia–ischemia (HI) is considered to be a common cause of perinatal brain injury followed by development of neurobehavioral impairments, which may be associated with the production of pro-inflammatory cytokines by activated microglia. The objective of the current study was to determine whether azithromycin, a putative suppressor of microglial activation, ameliorates HI-induced brain inflammation and neurobehavioral dysfunction. HI was achieved by bilateral common carotid artery ligation followed by hypoxic exposure (8% oxygen) for 15 min in postnatal day 5 (P5) Sprague-Dawley rats, and azithromycin (40 mg/kg) or vehicle (PBS) was administered intraperitoneally after HI exposure. Neurobehavioral tests were performed and brain inflammation was examined on P6. Our results showed that hypoxic-ischemic insult increased levels of microglia activation-related pro-inflammatory cytokines including interleukin-1β (IL-1β) in the P6 rat brain, and affected physical development and sensorimotor neurobehavioral deficits in P6 rats. Treatment with azithromycin significantly improved neurobehavioral performance in righting reflex, negative geotaxis, wire hanging maneuver, and hind limb suspension tests in P6 rats. Azithromycin also reduced hypoxia-ischemia-induced brain inflammation as evidenced by the decreases in the content of IL-1β in the P6 rat brains. The overall results suggest that reduction in microglia activation-related pro-inflammatory cytokines may protect neonatal brain and neurobehavioral disturbances from HI injury.

G-P46 ADAPTIVE THERMAL HISTORY DEIDENTIFICATION FOR PRIVACY-PRESERVING PROCESS-DEFECT MODELING OF METAL BASED ADDITIVE MANUFACTURING

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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.

G-P47 HYDROBORATION OF CARBONYL COMPOUNDS USING A [Ni{(κ1-P)(η2-SiHMe)}(PPh3)2] AND[Ni(H)(PSiiPr)(PPh3)] CATALYST AT MILD CONDITIONS

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Silylphosphines such as PSiHx (x= methyl or isopropyl) are a kind of bidentate ligands with strong sigma donor character, ideal to synthesize nickel(II) complexes via oxidative addition of the Si-H moiety by the metal center.1 Moreover, nickel is a low-cost transition metal, abundant and easy to handle. Therefore, a nickel(II) silylphosphine family of complexes has been synthesized, characterized by 1H NMR and 31P{1H}- MR, and used as a catalyst in the hydroboration reactions. Hydroboration of aldehydes and ketones has been demonstrated as an excellent synthetic path to functionalize organic molecules to be used as starting materials in further reactions such as C-C coupling2 or to access to primary or secondary alcohols after the hydrolysis of the boronated ester.3 This nickel(II) catalyst system (Scheme 1. Ni1 and Ni2), hydroborates aldehydes and ketones chemoselectivity with HBpin at room temperature using a low catalytic load in benzene.

G-P48 ACHIEVING HIGH-SPEED RETRACTION IN STRETCHABLE HYDROGELS

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Hydrogels have many potential applications, such as in prosthetic devices and other stretchable materials requiring high stretchability and good mechanical properties. In nature, elastomeric biopolymers, like resilin, display high stretchability and resilience, leading to power-amplified movement necessary for feeding, and defensive mechanisms. In our research, we obtained highly stretchable polyacrylamide (PAm) hydrogels prepared by UV curing. These gels are prepared at varying volume fractions . The gels with a volume fraction of 14% display a a high elastic modulus of ~7 kPa and a stretchability of ~ 900%. These gels retract very quickly when released from a stretched stage. We achieved a maximum retraction velocity of 6 m/s and an acceleration of 600 m/s^2 when released from a stretch of 6. These gels can have applications in soft robotics, prosthetics, and designed devices and can be synthesized by tuning the facile synthetic technique described here.

G-P49 ROOT PHENOTYPING AND TRAITS CHARACTERIZATION THROUGH COMPUTER VISION AND DEEP LEARNING

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Root phenotyping allows gain insights into the root structure, function, and response to various environmental stimuli. The information obtained through root phenotyping can be used to improve crop yields, develop new plant varieties that are better suited to specific environmental conditions, and enhance overall plant health. Root trait measurements such as root length, area, and volume are traditionally done manually, which is time-consuming and resource intensive. This study introduces a deep learning-based computer vision image processing method for soybean root segmentation, using regular RGB images captured under an illumination-controlled environment. The aim is to develop an automated analyzing pipeline to extract root architectural traits. In this context, a diverse set of soybean root imagery (200 images) data was collected using an in-house-assembled root imaging platform, with an image resolution of 3840 x 2,160 and 5184 x 3456 with pure black imaging background. Before taking images, ground truth data such as total lengths of roots and other seedling traits were recorded manually. During data acquisition, various camera configurations were tested. Image segmentation involves classifying every pixel in an image into a certain category, such as roots or background. Root segmentation is challenging because of their thin and complex structures, especially when a considerable number of sub-roots are developed. In our preliminary tests, we trained a convolutional neural network (CNN)-based deep learning model called ITERroot from scratch with the acquired images. With our developed analyzing pipeline, root architectural traits can be extracted accurately.

G-P50 EFFECT OF PLANT POPULATION, HYBRID VARIETY AND NITROGEN RATES ON CORN PHENOTYPE

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Corn (*Zea mays* L.) is a staple food and feed worldwide. With increasing food demand, it is important to fill the existing corn yield gap while improving corn quality. Historically, increasing plant population and optimum nitrogen (N) management have been important approaches. However, the relationship between higher plant population with distinct N rate on plant morphology such as plant height, stalk diameter and soil-plant analysis development (SPAD) are still being explored. Therefore, a two-year multi-site study was conducted to evaluate the effects of management practices (hybrid selection, plant population and nitrogen rate) on plant characteristics and corn yield. The tested factors include N rates (0, 112, 224, and 336 kg N ha^{-1}) as main plot, and a factorial between plant populations (75,000, 87,500, 100,000 and 112,500 plants ha^{-1}) and corn hybrids with and without Bt traits (DKC 70-27 and DKC 70-25) as subplot factor, with four replications of main plot. The overarching aim is to determine the agronomic optimum plant population (AOPP) and agronomic optimum nitrogen rate (AONR)

to improve corn yield and quality. Preliminary results will be presented.

G-P51 VISUALIZING BLOOM-TIME VARIATIONS IN Asclepias (Milkweeds) ACROSS MISSISSIPPI

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Milkweeds are important nectar and host plants for many species of butterflies, bees, and true bugs. Each of Mississippi's milkweed species bloom and fruit at different times. Patterns in local and regional milkweed bloom times may partially explain divergent pollinator preferences at different times of year. Furthermore, range overlap of pollinators and milkweeds may determine the relative significance of milkweed floral resources in individual pollinator diets. Citizen science data from iNaturalist was annotated and mapped in an ArcGIS Dashboard. The data indicate that Mississippi milkweeds bloom at different times than conspecific milkweeds in other regions of the United States and that insect floral preferences may be influenced by temporal and geospatial overlap with blooming milkweeds. This research demonstrates the feasibility of studying continental trends in plant phenology and pollinator ecology using iNaturalist data.

G-P52 CARBOXYLESTERASE 1 (CES1) REGULATES PROSTAGLANDINS AND CD206 IN VITRO AND IN VIVO M1 AND M2 MACROPHAGES

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Macrophages are important cells of innate immunity that respond directly to pathogens and tissue damage, thereby alerting the immune system. Depending on the stimuli in their microenvironment, they can be polarized toward a microbicidal and proinflammatory phenotype (classical activation) that secrete high levels of toxic cytokines and prostaglandins or toward an anti-inflammatory phenotype (alternative activation) that promotes tissue repair. Carboxylesterase 1 (human/murine nomenclature: CES1/Ces1d) is a member of the serine hydrolase superfamily that catalyze the hydrolysis of some drugs and neutral lipids. They have been shown to regulate triacylglycerol (TAG) levels in macrophages. Because CES1 regulates TAGs, knocking down CES1 was hypothesized to impact prostaglandins production. CES1 expression was knocked down by transduction with a lentiviral CES1 shRNA construct. Liquid Chromatography Mass Spectrometry (LC-MS) was used to measure the prostaglandins. RT-qPCR and RNA SEQ were used to quantify gene expression, while flow cytometry was used to measure CD206 protein expression. CES1 knockdown (CES1KD) THP-1 macrophages that were activated with LPS (1 µg/mL) produced significantly higher levels of prostaglandins and genes responsible for their production over 24 hours when compared to macrophages that express normal levels of CES1 (control). *CD206* mRNA, a marker of alternative activation, increased in CES1KD macrophages than control macrophages. Flow cytometry showed that CD206 protein expression was higher on alveolar macrophages derived from lungs of *Ces1d*$^{-/-}$ mice compared to wildtype mice following 3 consecutive days of intranasal IL-4 administration. Our results show that CES1 might exert a regulatory effect on macrophage polarization.

G-P53 IMPACT OF SALT STRESS ON EARLY-SEASON GROWTH AND DEVELOPMENT IN SORGHUM

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Salinity is a major environmental stressor, particularly in arid and semiarid regions where sorghum (*Sorghum bicolor* (L.) Moench) is widely cultivated. In addition, sorghum exhibits high resilience in those environments where other crops struggle to grow. Despite its importance, little is known about how sorghum genotypes respond to salt stress at a morpho-physiological level during the early season. This study aimed to identify salt-tolerant genotypes and traits in sorghum by subjecting twelve different sorghum genotypes to two different salt stress levels (0 and 8 dS m^{-1}) during the early-vegetative stage in a sunlit growth chamber facility. Twenty-eight days after treatment, physiological and biomass-related traits were recorded. The results showed that chlorophyll content increased by 28%, with the highest increase seen in NK6638, while transpiration decreased by 46% and leaf temperature increased by 2 °C under salt stress compared to the control. Sorghum genotypes grown under salt stress experienced significant reductions in plant height (42%), leaf area (43%), and shoot biomass (39%), but root dry weight and root-to-shoot ratio increased by 12% and 67%, respectively. Total biomass was reduced by 28% under salt stress compared to the control, with the highest reduction seen in DKS53-53 and the lowest in NK6638. Overall, NK6638 and SC35 showed the least reduction in early-season growth and development traits under salt stress compared to the control. Growers could utilize these salt-tolerant genotypes to ensure higher yields in areas where salt stress is a major challenge. Moreover, identified salt-tolerant donors could be a potential resource for developing resilient sorghum cultivars that can withstand salt stress.

G-P54 DIVERGENT SELECTION FOR ANTHESIS OF ANNUAL RYEGRASS (*Lolium perenne* ssp. multiflorum)

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Annual ryegrass (*Lolium perenne* ssp. *multiflorum*) is an abundant cool-season species in the Southeast. It has escaped its pasture locations and has spread into winter-fallow row crop fields. While its establishment and density qualify it as an excellent cover crop, its late senescence and multiple herbicide resistance make it difficult to kill at spring planting. If we could develop a ryegrass variety that naturally senescence early in the spring, we could exploit the benefits of ryegrass as a cover crop (weed suppression, soil stabilization, nutrient scavenging). This study is conducted to evaluate the annual ryegrass response to recurrent phenotypic selection for earlier and later anthesis dates. A base population was collected in 2022. This population had anthesis dates ranging from 21 March to 2 April, with a mean date for the anthesis of 28 March. Nine hundred and three seedlings of this population were grown in the 50-cell deep trays under ambient outdoor conditions. To establish two distinct populations (Early and Late), progeny with anthesis prior to 21 March and the final seventy populations that are the last to anthesis are selected. Selected plants will be allowed to intermate with each other within each group. Seed harvested will be used as a base for the second cycle of selection. After two cycles of selection, genetic variation will be calculated to assess gain due to selection using X^2, ANOVA, and h^2 for the anthesis date. The early population will be used as a cover crop, and individuals in the late population will serve as an enhanced forage variety.

G-P55 TECHNO-ECONOMIC ASSESSMENT IN DETERMINING BIOMASS QUANTITIES IN POPLAR

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Populus spp. (poplar) are the fastest-growing trees in North America, making them ideal for a range of applications as they can achieve high yields on short rotations and regenerate by coppice. Furthermore, poplar undergoes biochemical conversion to fuels without complexity, making it one of the most promising, purpose-grown, woody perennial energy sources. Employing wood-based biomass for bioenergy offers numerous benefits, including reducing greenhouse gas (GHG) emissions compared to non-renewable

traditional fuels, the preservation of robust forest ecosystems, and creating economic prospects for rural communities. In order to gain a better understanding of the potential use of poplar as a biomass feedstock for biofuel in the southeastern US, we conducted a techno-economic assessment (TEA). This assessment is an analytical approach that integrates technical and economic factors of a production system to evaluate its economic viability. TEA specifically focused on a short rotation coppice system employing a single-pass cut-and-chip harvesting method for poplar. It encompassed all the costs associated with establishing dedicated poplar plantations, including land rent, site preparation, planting, fertilizers, and herbicides. Additionally, we performed a sensitivity analysis to evaluate how different costs can affect the economic performance of the poplar cropping system. This analysis aimed to determine the minimum average delivered selling price for one metric ton of biomass necessary to achieve a desired rate of return over the cropping period. Data on the establishment, crop care, and crop yields were obtained from field studies conducted at the Bearden Dairy Research Center and Pontotoc Ridge-Flatwood Branch Experiment Station of Mississippi State.

G-P56 FIELD PERFORMANCE OF BIOSTIMULANTS IN CORN PRODUCTION

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Biostimulants are substances that modify plant physiological processes and enhance yield, N uptake, and reduce environmental perturbations. Previous research has primarily focused on horticultural crops under control environmental conditions and lesser importance given for cereals especially corn under field conditions. Therefore, a study was conducted at two different locations within Mississippi (MS) testing biostimulants. The objective of this study is to evaluate impact of biostimulants on corn yield at variable nitrogen rates. Field trials were conducted at two experimental stations at Starkville and Stoneville, MS. A total of 36 plots including 12 controls were replicated four times within a split-plot design where N rate was the main plot factor. Six commercially extracted microbial biostimulants (Source®, Envita, iNvigorate®, Blue N, Micro AZ™, and Bio level phosN) at their recommended rates were foliar dispensed at V4-V5 stages as subplot factors. Four different N rates 0, 89, 179, and 269 kg N ha^{-1} at Starkville, whereas an additional rate of 224 kg N ha^{-1} were incorporated at Stoneville in 2022. Within the first year, Stoneville observed significant yield differences with N rates and biostimulants with yield ranging from 7.5 to 13 Mg ha^{-1} whereas Starkville did not. Additionally, no interaction effects were noted at either location. Specifically, yield increased with the application of 89 kg N ha^{-1} over the check plot, and no significant differences were noted between 89 kg N ha^{-1} and higher N rates. Significant differences were noted within biologicals. However, this was not statistically different from the check plot where no biological was applied.

G-P57 APPLICATION OF AMINATED-TEMPO-NANO-CELLULOSE COMPOSITE (ATNC) AEROGEL AS A NEW ADSORBENT FOR THE REMOVAL OF ANTIBIOTICS FROM WASTEWATER

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Antibiotics are used for the well-being of human beings and other animals. Detectable levels of antibiotics can be found in pharmaceutical, municipal, and animal effluents. The pharmaceutical industry's standard wastewater remediation strategy does not remove antibiotics from wastewater. Antibiotic resistance and clean water availability are growing concerns worldwide; hence, efficient methods are needed to remove antibiotics from wastewater. Cellulose, one of the most common renewable and sustainable polymeric materials, can be transformed into nano-cellulose, making it both an incomparable and intriguing resource element. In this experiment, we fabricated a sustainable aminated-TEMPO-nano cellulose composite (ATNC) aerogel to remove some antibiotics, such as cephalexin, ciprofaxin, and amoxicillin, from synthetic wastewater. The ATNC was characterized using different characterization techniques, including Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM), elemental analyzer, and thermogravimetric analysis (TGA). After that, ATNC was applied to remove the antibiotics and examined the influence of dosage, pH, and contact time. The adsorption isotherms, adsorption mechanisms, and regeneration potential of the ATNC were investigated.

G-P58 CLIMATE VARIABILITY AND ITS IMPACT ON MISSISSIPPI CORN YIELD

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Climate change poses a significant threat to agriculture. However, climatic trends and their impact on Mississippi (MS) maize (*Zea mays* L.) are unknown. The objectives were to: i) analyze trends in climatic variables (1970 to 2020) using Mann-Kendall and Sen slope method, ii) quantify the impact of climate change (based on growing season averages) on maize yield in the short and long run using the auto-regressive distributive lag (ARDL) model, and iii) categorize the critical months for the maize-climate link using Pearson's correlation matrix. The climatic variables considered were maximum temperature (Tmax), minimum temperature (Tmin), diurnal temperature range (DTR), precipitation (PT), relative humidity (RH), and carbon emissions (CO_2). The pre-analysis (multicollinearity, unit test, optimum lag selection, and cointegration), post-analysis (serial correlation, heteroskedasticity, and parameter constancy), and model robustness statistical tests were tested, and all conditions were met. A significant upward trend in Tmax (0.13 °C/decade), Tmin (0.27 °C/decade), and CO_2 (5.1 units/decade), and a downward trend in DTR (-0.15°C/decade) were noted. The PT and RH increased by 4.32 mm and 0.11% per decade, respectively, despite the noted trend being insignificant. The ARDL model explained 76.6% of the total variations in maize yield. Most notably, the maize yield had a negative correlation with Tmax for June, and July, with PT in August, and with DTR for June, July, and August, whereas a positive correlation was noted with Tmin in June, July, and August. Overall, a unit change in Tmax reduced the maize yield by 7.39% and 26.33%, and a unit change in PT reduced it by 0.65% and 2.69% in the short and long run, respectively. However, a unit change in Tmin and CO_2 emissions increased maize yield by 20.68% and 0.63% in the long run with no effect in the short run. Overall, it is imperative to reassess the agronomic optimum management strategies in the face of local crop-climate interactions. Also, developing and testing cultivars adaptable to the revealed climatic trend, with the ability to withstand severe weather conditions, could be helpful in ensuring sustainable maize production.

G-P59 HISTORICAL RECORDS ON SOYBEAN CROP CLIMATE LINK SINCE 1970: AN EXPERIENCE FROM MISSISSIPPI

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Analyzing how crops reacted historically to climate at finer scale is essential for adapting US agriculture to twenty-first century climate, however, crop-climate estimations in Mississippi (MS) are elusive. Therefore, the present study attempted to i) estimate climate trends in MS during soybean growing season (SGS) from 1970-2020 using Mann-Kendall and Sen slope method, specific variables considered were maximum temperature (Tmax), minimum temperature (Tmin), diurnal temperature range (DTR), precipitation (PT), carbon dioxide emissions (CO_2), and relative humidity (RH), ii) calculate the impact of climate change (growing season average) on soybean yield using the auto-regressive distributive lag (ARDL) econometric model, and iii) identify the most critical months from crop-climate perspective by generating a correlation between the detrended yield and the monthly averages for each climatic variable. All the required diagnostic tests for the pre-analysis (multicollinearity, unit root problem, ideal lag length selection, and cointegration check), post-analysis (heteroskedasticity, coefficients stability, and serial correlation), and model sensitivity were tested, and conditions were met. A significant positive trend in Tmin (+0.25°C/decade) and CO_2 (+5.14 units/decade), and negative trend in DTR (-0.18°C/decade) was found. Although the Tmax, PT, and RH showed non-significant trends, changes were noted as +0.11°C/decade, +3.03 mm/decade, and -0.06%/decade, respectively. The ARDL model explained 79.9% of the total soybean yield variability caused by climate change. Furthermore, soybean yield was positively correlated with Tmin (in June and September), PT (in July and August), and RH (in July), but negatively correlated with Tmax (in July and August) and DTR (in June, July, and August). Soybean yield was observed to be significantly reduced by 18.11% over the long term and 5.51% over the short term for every 1°C increase in Tmax. Nevertheless, there was a significant increase in soybean yield, measured by unit changes in Tmin and CO_2, of 7.76% and 3.04%, respectively. Altogether, soybeans in MS exhibited variable sensitivity to the short and long terms climatic changes. The results highlight that testing the best agronomic practices and climate resilient cultivars must encompass these asymmetric sensitivities due to the regional climatic conditions of MS.

G-P60 ANALYSIS OF SYSTEMIC ACQUIRED RESISTANCE BY MONITORING REDOX-MEDIATED TRANSCRIPTIONAL DYNAMICS IN ARABIDOPSIS

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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 four days in 12 h light and 12 h dark diurnal cycles. We observed oscillatory dynamics of the GRXS*13* 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.

G-P61 EFFECT OF INDENTATION LOAD ON VICKERS HARDNESS FOR THERMOPLASTIC MATERIALS

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Microhardness indentation techniques are used for elastic modulus calculation in brittle materials. Their validity to determine the elastic modulus of thermoplastic polymers like Teflon and Nylon 11 has to be tested. The Vickers' hardness of the material is first calculated for this. The purpose of the study was to determine the effect of indentation load on Vickers' hardness for unfilled thermoplastic polymers utilizing a microhardness tester. Square plate specimens were fabricated from Teflon (n=4) and Nylon 11 (n=4). Nylon 11 and Teflon specimens were polished to 6 microns and 30 microns surface finish respectively, using the Multiprep™ polishing equipment (Allied High-Tech Products). The specimens were sputter coated with 10 nm gold. The Vickers' hardness was calculated using the Clark Microhardness Tester (Vickers/Knoop) CM-400AT. The Teflon and Nylon samples were indented (n=6 each) using 0.0982 N, 4.91 N, and 9.82 N indentation loads at a consistent dwell time of 15 seconds, and the lengths of both indentation diagonals were measured. Vickers' hardness was calculated as the load divided by the surface area of the indentation. The Vickers' hardness values for different loads were observed to be of non-linear relationship as seen in the plotted graph. They seemed to have reached a plateau for both samples as the load applied increased. In conclusion, laboratories may utilize the microhardness tester for calculating the hardness of an unfilled polymeric material at larger loads. These values may be suitable to be used in elastic modulus calculations, instead of using the limited standard (ASTM D2845).

G-P62 FERROCENE LINKED XANTHENE DYES FOR ELECTROCHROMIC APPLICATIONS

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Electrochromic materials are stimuli-responsive smart materials that present an electrochromism phenomenon, where there is reversible optical change under an applied electric potential (redox). This optical switching behavior gives these materials remarkable attention for potential applications, such as smart windows, rear-view mirrors of automobiles, electronic tags, shelf labels, and electromic displays. One example of an electronic display is bistable displays that do not consume energy in either state (open-color form or close-colorless form of xanthene dyes) and can switch between states with low energy inputs. A variety of xanthene dyes functionalized with a ferrocene unit were synthesized and studied for their potential electrochromic properties. In principle, our focus is on two main compounds: Rd-B-Hydrazine-Ferrocene and Rd-B-Ferrocene. Here, we combine the fluorescent properties of stable xanthene-based dyes and the electroactive ferrocene unit that is linked to the xanthene core and study the optical and redox property of dyes. We were able to show reversibility in the UV and CV studies. A switchable change occurs between states when applying different potentials, as well as by pH and chemical oxidation. Future work will include an extension to changing the donor groups in the xanthene core to access a variety of colors.

G-P63 MICROPLASTIC DETECTION IN CHICKEN MEAT: A NOVEL APPROACH USING HYPERSPECTRAL IMAGING AND DEEP LEARNING

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Microplastic contamination in food products is a growing environmental and health concern. This study presents a novel approach for the identification and classification of microplastics in chicken meat using hyperspectral imaging and 1D convolutional neural networks. Hyperspectral imaging provides detailed spectral information across a wide range of wavelengths, making it a valuable tool for the analysis of microplastics. In this study, we acquired hyperspectral images of chicken meat samples contaminated with known microplastic particles using the Micro-Hyperspec Ext-VNIR-HSI camera. The camera operates in the spectral range of 600-1700 nm, allowing for comprehensive spectral analysis of the samples. The dataset comprises 52 images collected from artificially implanted plastic samples found in chicken meat. It has 12 types of plastics, including PS, PP, PVC, PET, LDPE, HDPE, PUR, RUB, FAB, TEF, ABS, and NYL. These images provide valuable insights into the presence and characteristics of these artificially implanted plastic types within the chicken meat samples. Using a 1D CNN architecture, we employed deep learning to identify and classify microplastics. Through extensive training on a labeled dataset, the model learned to extract discriminative features from hyperspectral data, enhancing accuracy. Our results demonstrated the effectiveness and accuracy of our approach. The 1D CNN model achieved an accuracy of 95% in distinguishing microplastics from the surrounding meat tissue and accurately classifying the plastic types. The utilization of hyperspectral imaging combined with 1D CNNs proved to be a powerful and efficient technique for microplastic detection.

G-P64 PRELIMINARY INVESTIGATION IN MODELLING AND SIMULATION OF POWER GRID BY USING PANDAPOWER

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Power system analysis tools are software applications used by engineers, researchers, and other professionals to simulate, analyse, and optimize power systems. These tools help in designing, testing, and maintaining electrical grids, ensuring their efficiency, reliability, and safety. One of the open-source tools that has gained prominence is pandapower. There are different steps to model a power grid by using pandapower: firstly, the network is created to supply the power, and then the buses are created according to the input given; then the external grid is created with maximum and minimum resistance values; and then the transformer is to be selected from the standard libraries or to be given by experimental values. The type of line and the distance between the lines need to be created. The above is the basic type of grid, but for a typical type of grid, we can also give the switches, generators, loads, different types of cables etc. From this investigation (survey) results, we can conclude that our preliminary investigations into the use of pandapower for grid calculations have demonstrated its potential as a valuable tool for analysing and modelling the power grid. The flexibility and ease of use offered by pandapower will enable us to simulate various scenarios, optimize grid performance, and identify areas for improvement. While the tool has some limitations, particularly in modelling dynamic phenomena such as the Ferranti effect, we are optimistic that future developments and enhancements will address these challenges. As a result, the use of pandapower in future research will contribute significantly to the advancement of the power grid, paving the way for a more efficient, reliable, and sustainable energy infrastructure in a region.

G-P65 REVEALING INTERACTIONS BETWEEN SOYBEAN LOOPERS (*Chrysodeixis includens*) and *chlorantraniliprole* BY TRANSCRIPTOME ANALYSIS

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Soybean loopers (*Chrysodeixis includens*) are a migratory pest of soybean and damages the crop causing defoliation. The pest annually migrates between the Central America and United States. Management of the pest has been successfully performed with diamides containing chlorantraniliprole and targeting ryanodine receptors over 15 years. However, the management with diamides has dealt with a decreased success rate in the crop fields in Puerto Rico (PR), which made us question resistance risk to diamides in the soybean loopers. Previously, we reported a mild resistance in a Puerto Rico soybean looper population to chlorantraniliprole. In this study, we focus on differences in gene expressions between the PR strain and the susceptible lab strain upon chlorantraniliprole exposure analyzing the transcriptome. Our current results show that several genes encoding detoxification enzymes such as cytochrome P450s, glutathione S-transferase, antimicrobial peptides, *takeout-like* proteins and cuticle proteins were upregulated in the PR strain. On the other hand, some genes encoding odorant receptors, regulatory proteins, and metabolic enzymes were downregulated. The analysis of the differentially-expressed genes (DEGs) is in progress; thus, further results will be discussed in detail later. Our future direction is to perform functional analyses to understand the roles of DEGs in diamide resistance of the soybean looper.

G-P66 EXTENDING THE THREE-DIMENSIONAL CULTURE OF ADIPOCYTES THROUGH SURFACE COATINGS

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Current *in vitro* culture techniques do not allow a gradual intracellular fat accumulation in the 3D arrangement of ADSCs over a long-term culture period and thus, fail to mimic the important features of progressing adiposity. Using coatings containing elastin-like polypeptide (ELP) and polyethyleneimine (PEI), we have cultured adipocytes as three-dimensional (3-D) spheroids over a relatively long culture period >5 weeks. The next goal is to extend this culture period to 8 weeks by incorporating arginine-Glycine-Aspartic Acid (RGD), which stimulates cell adhesion on artificial surfaces, into the ELP-PEI coatings. ELP conjugated with RGD was obtained from genetically modified *E.coli* bacteria modified to express ELP-$(RGD)_3$ and $(RGD)_3$-ELP via suspension culture. The ELP-RGD conjugates were modified with polyethyleneimine (PEI, MW= 800 Da) and 5 mol% of 5 mg/mL conjugate was used to coat the well plates. Long-term culture was stimulated through a Frequent Media Change Assay developed in-house to determine which coating performs best for future long-term cultures. Using optical microscopy, we observed that ELP-$(RGD)_3$-PEI coating supported better spheroid retention with minimal spheroid loss during Frequent Media Change Assay. DNA Assay results revealed that ELP-PEI coating suffered a significant decrease in the DNA content after the 20 media changes ($p < 0.05$), indicating spheroid loss. There was no significant difference in DNA content before and after 20 media changes observed for ELP-$(RGD)_3$-PEI and $(RGD)_3$-ELP-PEI coatings ($p > 0.05$). The optical microscopy and DNA assay data for Frequent Media Change Assay revealed that ELP-$(RGD)_3$-PEI coating supported better spheroid retention with minimal spheroid movement.

G-P67 PIGMENT TRANSPORTER MUTAGENESIS USING CRISPR/CAS9 IN THE SOYBEAN LOOPER (*Chrysodeixis includens*)

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Pigment transporter genes have been used as visible markers or classic genetic studies to create genetic control for destructive crops pests. CRISPR/Cas9 technology has significantly advanced research on non-model organisms, but it has not been successful in gene

editing for the soybean looper, *Chrysodeixis includens*, due to the limited genomic information and embryonic microinjection techniques. Here we report a heritable knockout mutagenesis in a pigment transporter gene, *scarlet*, in *C. includens* using CRISPR/Cas9-mediated genome editing. The *scarlet* locus identified in a genome assembly of *C. includens* consists of 14 exons and extends for 1,986 bp. Two small guide RNAs (sgRNAs) were designed to target the first exon of *scarlet*. Microinjection of Cas9 protein and two sgRNAs into embryos successfully produced variable phenotypes with mutant eyes, accounting for about 16 % of mutation ratio. Genotype analysis revealed different indel mutations at the target site, resulting in a premature stop codon by frameshift. Single-pair mating of the mutant moths produced G1 offspring, and the homozygous mutant strain was established in G2. The mutant moths exhibited lightly pigmented compound eyes in both sexes, suggesting that *scarlet* may serve as a visible phenotypic marker for the tool. Our results provide the first successful case that the CRISPR/Cas9-mediated genome editing effectively induces mutations in *C. includes*, an economically important pest species in the Southern United States.

G-P68 ROLE OF SMALL PEPTIDES IN REGULATING RICE RESPONSES TO DROUGHT

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Abiotic stresses such as heat, drought and salinity are main factors limiting crop production. Improving plant resilience to stress are key to sustainable and future agricultural productivity. A significant part of the cell-to-cell communication in plants is mediated by small signaling peptides. Recently, small signaling peptides have emerged as an important class of regulatory molecules in plants involved in the control of plant growth and development. However, the involvement in small peptides as regulatory molecules in abiotic stress responses remains to be determined. In this study, we examined the effects of drought stress on the expression of small proteins/peptides. Small proteins/peptides were extracted from the leaves and roots of rice plants subjected to drought stress as well as from the control plants. The extracted proteins/peptides were separated by tricine-sodium dodecyl sulphate polyacrylamide gel electrophoresis. Two peptides were found to be up-regulated by drought stress. The amino acid sequences of the up-regulated drought-responsive peptides were analyzed by mass spectrometry-based de novo sequencing. These results suggest that drought-responsive peptides may play an important role in drought stress perception and response. Further functional analysis of the drought-responsive peptides will elucidate their roles in drought adaptation and tolerance in rice.

G-P69 CATFISH CUTTING AUTOMATION THROUGH COMPUTER VISION AND DEEP LEARNING

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Mississippi is one of the top four states producing catfish in the United States, along with Alabama, Arkansas, and Texas. Catfish is enriched in protein with good taste, and its production contributes greatly to the development of the local economy. Catfish processing steps include stunning, washing, de-heading, gutting, filleting, skinning, portioning, trimming, and grading, which are crucial before letting them go to the market. Most of these steps are manual and involve blade-based devices to handle, which may lead to catfish meat contamination and/or wastage ending in a low yield of final products. Automated catfish cutting is potentially a promising solution with less or zero human involvement to tackle the issues. This study presents a novel computer vision-based approach for the automated catfish cutting process that the catfish body parts are segmented using deep learning and semantic segmentation. In total, 396 raw and augmented images were utilized as the train, validation, and test data sets with five state-of-the-art deep learning models, including PSPNet, BEiTv1, SegFormer-B0, SegFormer-B5, and ViT-Adapter. The background, body, head, fins, and tail of catfish were the five pre-defined and labeled classes to guide the automated cutting system to the regions of interest. Overall, SegFormer-B5 outperformed the other four models with 89.2% of mean intersection-over-union (mIoU) and 96.4% of mean pixel accuracy, whereas ViT-Adapter dominated with 98.9% of pixel-wise accuracy in the test set. The inference speed of SegFormer-B5 was 0.278 sec per image, which could be implemented in near real-time for the cutting system.

INVESTIGATOR POSTER (I-P)

I-P70 EXPLAINABLE ARTIFICIAL INTELLIGENCE FOR CORN YIELD PREDICTION USING UAV MULTISPECTRAL DATA

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Crop yield prediction is crucial for agricultural management and food security. Conventional approaches of yield estimation are time- and cost-ineffective. Explainable Artificial Intelligence (XAI) coupled with remotely sensed data from different platforms have been successfully used to predict crop yields. Conventional Machine Learning (ML) Models are often criticized due to their 'black box' nature, which makes it difficult to understand how they make predictions. This study develops XAI models to predict corn yield using multispectral data acquired using Unmanned Aerial Vehicle (UAV). Twenty-four different vegetation indices (VIs) were derived from two corn fields located in Starkville and Brooksville, Mississippi, at the vegetative stage (V6) to identify the most suitable VIs. Different algorithms such as K-Nearest Neighbor (KNN), Principal Component Regression (PCR), Random Forest (RF), Support Vector Machine (SVM), and Neural Networks (NN) and their ensembles were evaluated to develop robust XAI models to accurately predict corn yield with explainability. Simplified Chlorophyll Content Index (SCCCI), Transformed Chlorophyll Absorption Reflectance Index (TCARI), and Normalized Difference Red Edge Index (NDRE) were among the most suitable VIs in predicting corn yield. The ensemble of SVM, RF, and NN significantly achieved higher accuracy (R^2 = 0.84–0.86 and RMSE = 1.03–1.2 Mg/ha) than the individual ML models (R^2 = 0.65–0.67 and RMSE = 1.54–1.59 Mg/ha). Local and global methods of model explanation such as permutational variable importance, partial dependence profiles, ceteris paribus profiles, and residual plots were employed to understand the performance of developed XAI models.

I-P71 EFFECT OF FLOODING ON THE METABOLISM OF QUINOA AND AMARANTH

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Climate change-induced alterations in the distribution and volume of precipitation are resulting in potential pressures on food security, as the traditional cropping patterns are becoming less reliable. In this

context, it is essential to understand how plants respond to these changes. Thus, the present work aimed to investigate the effect of flooding on the metabolism of amaranth cv. BRS Alegria and quinoa cv. BRS Piabiru. An experiment was carried out in a greenhouse using a completely randomized design with ten replicates per treatment. The plants were subjected to flooding in the transition from the vegetative and reproductive phase for periods of 48-hour and 96-hour flooding treatment-induced changes or 72 hours following soil drainage (recovery) in (i) photosynthetic pigments, (ii) net CO_2 assimilation and other gas exchange-related parameters, and (iv) activities of antioxidant enzymes (superoxide dismutase (SOD), ascorbate peroxidase (APX), and catalase (CAT)) were quantified in addition to peroxide content and lipid peroxidation in shoots and roots. The results show that for both C3 and C4 species, the content of chlorophyll *a* and chlorophyll *b* remained similar to the control, while the content of carotenoids was reduced even after recovery. There was a reduction in net photosynthesis, stomatal conductance, and internal CO_2 concentration in both species during the flooding and recovery periods, however, quinoa plants had a more pronounced reduction compared to Amaranth. Reactive oxygen species (ROS) production increased significantly across both species and treatment periods, while the antioxidant system differed across species and organs. At 96 hours after flooding, both amaranth and quinoa showed increased antioxidant activity, primarily in APX and CAT, whereas on recovery, roots showed CAT and SOD values similar to controls for quinoa plants. A significant metabolic change was observed in both species during 48 and 96 hours of flooding since ROS production was high in all conditions. During the recovery process, both species were able to maintain gas exchange and combat ROS by sustaining pigments similar to the control. This was possible by the maintenance of the activity of antioxidant enzymes, which proved to be superior to the control even after the recovery period. Therefore, we can infer that both amaranth and quinoa's antioxidant systems are capable of preventing oxidative damage that might compromise productivity.

I-P72 ROBUST UNSUPERVISED DOMAIN ADAPTATION FOR EXTRACAPSULAR EXTENSION IDENTIFICATION IN HEAD AND NECK CANCER

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Obtaining ground-truth label information from real-world medical image data along with uncertainty quantification can be challenging or even infeasible. In the absence of labeled data for a certain medical image analysis task, unsupervised domain adaptation (UDA) techniques have shown great accomplishment by learning transferable knowledge from labeled source domain data and adapting it to unlabeled target domain data. In this research, we proposed a distributionally robust unsupervised domain adaptation (DRUDA) method to enhance an explainable machine learning model. We investigated its application to extracapsular extension (ECE) identification in head and neck cancer using computed tomography (CT) imaging. Distributionally robust learning (DRL) is emerging as a high-potential technique for building reliable and generalized machine learning systems that are robust to distribution shifts. In this study, the proposed DRL-based UDA learning scheme is formulated as a min-max optimization problem by optimizing worst-case perturbations of the training source data. In addition, a gradient mapping-guided explainable network (GMGENet) is proposed to identify the occurrence of ECE. In a joint training process, informative volumes of interest (VOIs) are automatically extracted without labeled lymph node region information. The adaptation from private data to public data is performed. The proposed DRUDA-enhanced GMGENet achieved 78.1% AUC and yielded an improvement compared to adaptation-free performance. The robust adaptation technique shows potential in transferring knowledge across different data sources and detecting the extension by providing intermediate heatmaps for clinical validation. The distributions of the extracted features with and without domain adaptation are compared. We demonstrate that the proposed DRUDA improves transfer performance on target domains for the 3D image analysis task. This research enhances the understanding of distributionally robust optimization in domain adaptation and is expected to advance the current unsupervised machine learning techniques. The outcome of this study will contribute to future practical implementations in head and neck cancer computer-aided diagnosis.

I-P73 SURVEY ON CHAT GPT AND ITS APPLICATIONS

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ChatGPT is a new artificial intelligence technology-driven natural language processing tool launched by OpenAI, an American artificial intelligence research laboratory. It uses the transformer neural network architecture, which is a model for processing sequence data with language understanding and text generation capabilities. In particular, it will train language or text models by connecting a large number of corpora, and it can also interact according to the context of the chats which is almost the same as a real human being. In this comprehensive survey, the Chat GPT development tree is introduced. The first version of GPT-1 was released in 2018; then Chat GPT 4 has been implemented in 2023, which is cutting-edge technology in the artificial intelligence and search engine. According to our survey, Chat GPT 4 has the following good features: 1-Visual Input Options: it can understand and analyze image input. 2- Higher Word limit: GPT-4 is capable of processing texts longer than 25,000 words, making it suitable for a variety of use cases. 3- Advanced Reasoning Skills: GPT-4 has outstanding performance in natural language understanding (NLU) ability and problem-solving ability. 4- Adjustment to Inappropriate Requests. GPT-4 has 82% lower response rate to requests for disallowed and sensitive content. 5-Guideability: Guiding ability is a concept in artificial intelligence that refers to its ability to modify its behavior as needed. 6- Fact-based Responses: GPT-4 is more likely to generate fact-based responses than the previous version. In this presentation, the disadvantages of Chat GPT 4 are also discussed. According to our literature survey, the Chat GPT-wide applications include, but not limited to customer service, healthcare, education, finance, E-commerce, human resources, legal, social media, and entertainment will be presented. The future development of Chat GPT is discussed in the presentation.

I-P74 GENOME-WIDE ASSOCIATION STUDIES OF MORPHO-PHYSIOLOGICAL AND YIELD TRAITS IN SOYBEAN

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Soybean plant architecture is an important agronomic characteristic for determining yield, and genotypes vary for morpho-physiological traits. Studies have shown that reproductive-stage biomass-related traits during reproductive development correlate with yield potential. Because the plants which produce higher vegetative biomass (source), tend to allocate more resources to developing reproductive structures (sink) such as pods and seeds. Therefore, this study focused on mapping genetic loci associated with morpho-physiological and yield traits in soybean under rainfed conditions. We explored natural variation in pigments and morphological traits using 457 soybean accessions from different maturity groups under field conditions. Our findings showed a substantial diversity index (H') across all traits, including flavonoid (6.12) and anthocyanin (6.12) indices, as well as the number of nodes, nitrogen balance index, and chlorophyll content (6.11), indicating significant natural variability. Reproductive-stage biomass was positively correlated

(*p<0.001)* with plant height (*r = 0.43*), node number (*r = 0.59*), and pod number (*r = 41*), while chlorophyll content was negatively correlated (*r = -0.53*) with specific leaf area. To identify significant genetic loci associated with these traits, we conducted a genome-wide association study (GWAS). Twenty-six loci were significantly associated with anthocyanin (4) and flavonoid indices (9), plant height (2), and pod numbers (11). Further, the haplotypes associated with these traits are mined to identify potential candidate genes. These haplotypes could be helpful for trait-based breeding programs to improve soybean yield and morpho-physiological characteristics.

I-P75 In situ DIFFUSE REFLECTANCE IR SPECTROSCOPY INVESTIGATION OF CO ADSORPTION OVER MESOPOROUS PT-CERIA

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Carbon monoxide (CO) is a widely used probe molecule for the characterization of catalysts. CO adsorption and activation over platinum group metals (i.e., Pt, Pd, Ir, Ru, Rh) and/or transition-metals are key steps in catalysis and serve as a reference for surface science and computational catalysis. Since Ceria has high surface area and excellent oxygen storage capacity it is commonly used as a catalyst or catalyst promoter. Moreover, the ordered mesoporous ceria doped with metal is found to exhibit superior physicochemical property and catalytic activity. Here, we compare CO adsorption spectra, including CO carbonyl, formate and carbonate peaks evolution on mesoporous Pt-ceria synthesized from silica templates including SBA-15, KIT-6, and COK-19 and investigate the pore structure effect, by *in situ* diffuse reflectance IR spectroscopy (DRIFTS) as a function of temperature. Ceria without template was also synthesized and studied as a control. It was shown that catalyst synthesized from the SBA-15 template has a larger integrated area of the Pt - CO_{ads} region than the KIT-6 and COK-19 counterparts, suggesting that ceria made from SBA-15 template is more efficient in maintaining the larger amount of metal sites and more stable carbonate species than the material made from KIT-6 and COK-19 template and without template. It is concluded that CO adsorption will serve as a reference for future CO-involved reactions such as water-gas shift reaction, CO oxidation and hydrogenation.

I-P76 COMPARATIVE ASSESSMENT OF MORPHOLOGICAL AND MOLECULAR GENETIC DIVERSITY AMONG POLE BEAN (*Phaseolus vulgaris L.*) GENOTYPES

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Pole bean *(Phaseolus vulgaris* L.) is an important leguminous crop used as a fresh vegetable as well as a seed. We investigated 125 pole bean genotypes for 24 quantitative traits. We used genetic divergence analysis using the K-means clustering and identified seven distinct clusters of the genotypes studied. Cluster VI was the largest with 31 genotypes followed by Cluster VII (28 genotypes), cluster I (22 genotypes), cluster III (19 genotypes), and Cluster V (18 genotypes), whereas Clusters II, and IV were the smallest (5 genotypes). The maximum and minimum intra-cluster distance was observed in cluster II (6.93) and cluster IV (5.05), respectively. Inter-cluster distance revealed clusters II and III (10.23) as the most divergent clusters followed by clusters I and VII (6.20). Molecular characterization of pole bean genotypes using simple sequence repeat (SSR) primers revealed a mean allelic frequency of 0.50 with a range of 0.35 to 0.90. The number of alleles amplified varied from 2 (PV-at001) to 7 (BM154) with an average of 4.35 alleles per marker. Correspondingly, molecular genetic diversity ranged from 0.19 to 0.75 with a mean value of 0.61 and the polymorphism information content (PIC) value ranged from 0.17 to 0.72 with an average of 0.55. Dendrogram using SSR data clustered the genotypes into two major clusters *viz*., cluster I and cluster II which were further subdivided into four and two sub-clusters, respectively. Assessment of the clustering patterns using morphological and molecular data revealed similarity in genotype grouping to a certain extent.

I-P77 TEMPERATURE AND ELEVATED CO_2 ALTER SOYBEAN SEED YIELD AND QUALITY AND EXHIBIT TRANSGENERATIONAL EFFECTS ON SEED EMERGENCE AND SEEDLING VIGOR

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Environmental conditions play a prime role in the reproductive performance of plants, and they can extend into their progenies. A study was conducted to examine the effect of temperature and CO_2 on seed yield and quality of two soybean cultivars (DS25-1 and DS31-243) in sunlit plant growth chambers and to check their transgenerational effects on seed emergence and seedling vigor. Three temperatures, 22/14°C (low), 30/22°C (optimum), and 38/30°C (high), and two CO_2, 410 (ambient) and 720 ppm (elevated (eCO_2)) were selected for the study. Significant temperature, CO_2, and genotype differences were recorded among all the measured yield attributes. At high temperatures, the total seed dry weight and 100 seed weight were less than the low and optimum temperatures in both cultivars. In all three temperature treatments, the cultivars performed better under eCO_2. Across the treatments, DS25-1 had higher seed yield-related traits than DS31-243. The F_1 generations also followed a similar pattern as the seed yield of the parental generation, giving the highest maximum seed emergence, lesser time to 50% emergence, and higher seedling vigor from parents grown at low and optimum temperatures under eCO_2. Despite the temperature treatments, DS25-1 exhibited higher emergence and vigor parameters under eCO_2. However, DS31-243 showed lower characteristics under high temperatures at eCO_2 than at ambient. Our findings suggest that parental stress can have a significant impact on the development of offspring plants. This indicates that epigenetic regulation or memory repose may be at play. Therefore, growing plants under optimal temperatures may be beneficial for soybean producers to guarantee seed quality and seedling vigor.

I-P78 COVER CROP AND POULTRY LITTER TREATMENTS ENHANCE SOIL MICROBIAL COMMUNITY STRUCTURE AND FUNCTION IN A DRYLAND SOYBEAN PRODUCTION SYSTEM

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Soil microbial communities are critical for maintenance of soil fertility. Soil management practices enhance the microbiota, which promotes soil health. However, the soil microbial communities differ under different soil management practices. Using different cover crop and fertilizer source treatments in dryland soybean production systems, we investigated how these management practices influence soil microbial diversity and community composition in soil samples collected in 2019 and 2022. Amplicon sequencing of bacterial and fungal genes were carried out using the

16SrRNA and ITS2 fragments, respectively. We analyzed and compared the microbial alpha and beta diversity indices across the years. Significant differences were observed in richness and diversity between 2019 and 2022. Specifically, 2022 had higher richness and diversity than 2019. Bacterial and fungal community structures were significantly different and showed a distinct cluster for both years. In 2019, cereal rye showed higher bacterial richness, and wheat showed lower bacterial and higher fungal richness than other cover crops in both years. For the fertilizer treatments, bacterial species richness and diversity were significantly higher in poultry litter compared to inorganic fertilizer in 2019 and 2022. While no differences were observed in fungal diversity. Cover crops and poultry litter promoted a greater abundance of beneficial microbial phyla in both years. Vetch and wheat exhibited the highest abundance of N-fixing bacterial genera, while native vegetation showed the lowest abundance. These differences in the soil microbial communities suggest that the use of management practices promoted a beneficial soil microbiome essential for maintaining soil health in dryland soybean production.

High School Poster (HS-P)

HS-P79 A BRIEF REVIEW OF THE PATHOPHYSIOLOGY, SIGNS AND SYMPTOMS, DIAGNOSIS, AND TREATMENT OF HASHIMOTO'S THYROIDITIS

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The purpose of this project was twofold: (1) to review the current body of knowledge on the pathophysiology, diagnosis, treatment, outcomes, and future considerations for research on Hashimoto's thyroiditis, and (2) to evaluate the encounters of Hashimoto's disease over the past ten years at the University of Mississippi Medical Center (UMMC) from 2013-2023. Hashimoto's thyroiditis is an autoimmune disorder where the immune system makes antibodies that attack the thyroid gland. Hashimoto's thyroiditis (aka Hashimoto's disease) occurs in 5 out of 100 Americans and is the most common cause of hypothyroidism in the US. Many people with Hashimoto's disease have no symptoms until the disease progresses into later stages. Early in the disease, the thyroid may enlarge and release higher levels of thyroid hormone resulting in hyperthyroidism. As the disease progresses, hypothyroidism ensues as more damage to the thyroid occurs. The most common signs and symptoms include fatigue, weight gain, cold intolerance, joint and muscle pain, constipation, dry skin, dry thinning hair, heavy or irregular menstrual periods, infertility, and slow heart rate. Risk factors include female sex, family history, other autoimmune diseases, history of certain viral infections, pregnancy, excessive iodine intake, poor psychological well-being, and radiation exposure. The diagnostic workup for Hashimoto's thyroiditis includes thyroid function tests (TSH, free thyroxine (fT4)) to confirm a hypothyroid state. Coupled with thyroid peroxidase antibodies (TPO), the diagnosis of Hashimoto's thyroiditis can be confirmed. Thyroid ultrasound is often used to detect a goiter or nodules. Treatment includes pharmacologic therapy with levothyroxine (standard dose = 1.6-1.8 mcg/kg/day) to restore the euthyroid state. Patients >50 years of age are treated with 25 mcg/day with reevaluation in 6-8 weeks. Patients undergo thyroidectomy in the later stages of the disease because of higher cancer risk. Current clinical trials are exploring dietary supplementation, laser light therapy, Identity Oriented Psychotrauma Therapy (IOPT), and Eye Movement Desensitization and Reprocessing (EMDR). Future research should include therapies targeted at the pathophysiological autoimmune mechanisms causing the disease. Encounters at UMMC were investigated for age, race, and gender. The results show significant number of encounters from age 8-19 with the peak encounters occurring around ages 14-16. The literature shows that average onset when Hashimoto's is detected is approximately 40 years of age. The predominance of the disease is found in whites (75%) and in women (77%), which is similar to the literature. Additional studies are needed to determine if earlier detection is seen in other regions of the country.

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