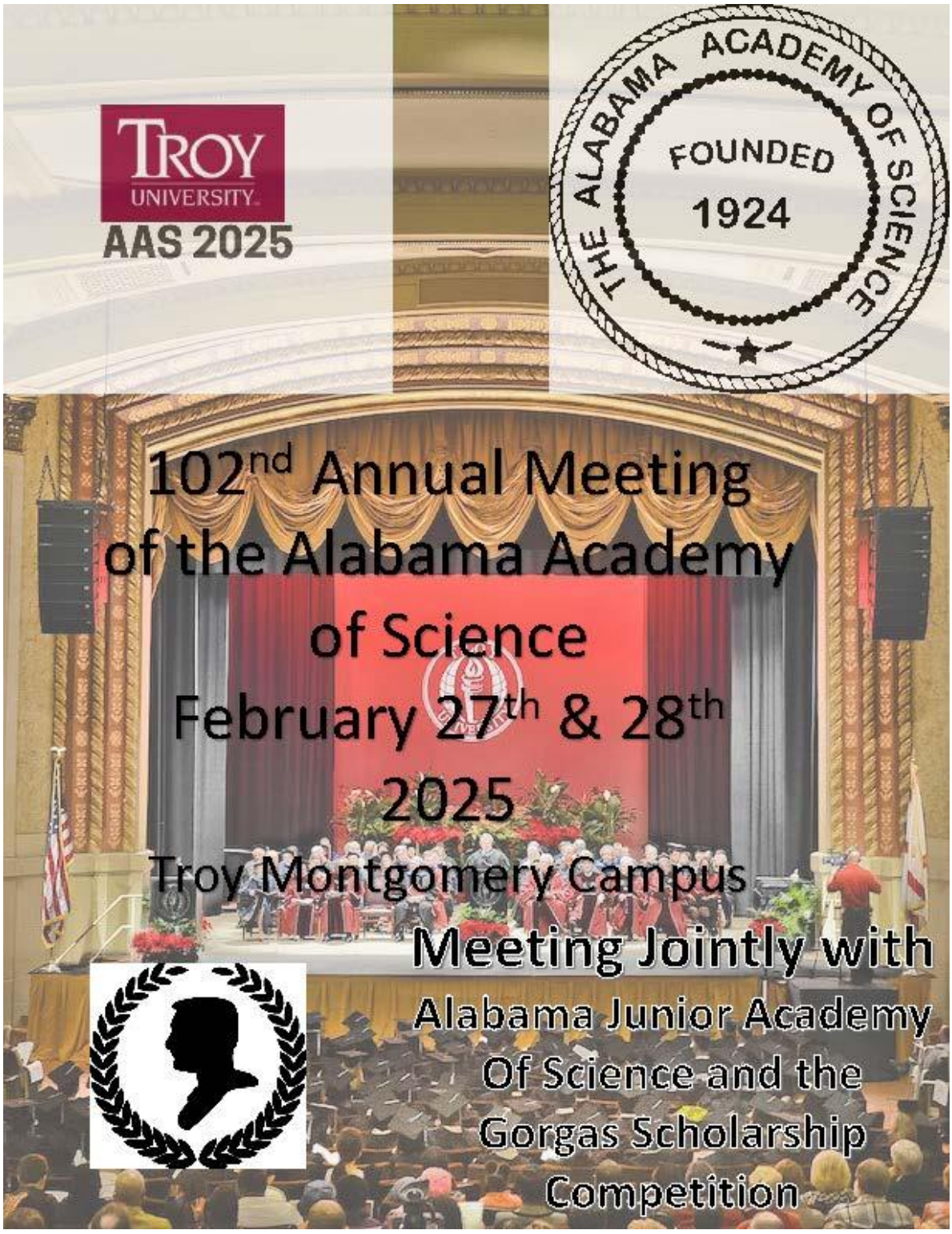


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# ONE HUNDRED-SECOND ANNUAL MEETING

# of the

# ALABAMA ACADEMY OF SCIENCE, INC.

Meeting Jointly With
ALABAMA JUNIOR ACADEMY OF SCIENCE
and
GORGAS SCHOLARSHIP COMPETITION PROGRAM BOOK
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**Cover Photo**. Background image is from the Davis Theatre for the Performing Arts located on the Troy University Montgomery Campus where the 102nd Annual Meeting was held. Photo courtesy Troy University Media Department.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Asymmetric Distribution of microRNA Target Sites within 3'UTR: Implications for Evolutionary Genomics and Bench to Bedside Research.** Alexander Kofman, Troy University; Franziska Ahrend, NIDDK; Travis Varnum, Troy University; Jiling Zhong, Troy University; Long Ma, Troy University; Vitaly Vitaly, Troy University; Siegfried Harden, Troy University.

Mammalian microRNAs bind to their mRNA target sites and trigger translational repression. Whereas the microRNA-binding sites are located within the protein-coding regions and even in the 5'UTR of the mRNA. However, the utmost functional microRNA targets, which are considered key cis-acting regulatory elements, are positioned within the mRNA 3'UTR whose impact on the fine-tuned gene expression is still to be elucidated. Using the original software tools, we analyzed the location of the predicted microRNA-binding sites within the 3'UTRs of about 4000 human genes using the datasets collected from the TargetScanHuman 8.0 (the 7- and 8mers structural variants of microRNA-binding sites) and NCBI (the 6mers structural variants) databases. We found that the distribution of the regular microRNA-binding sites differs from that of the homologous (repeated) sites. There was a very strong correlation between the length of the 3'UTR sequence and the density of homologous sites, whereas the regular microRNA-binding sites were characterized by the inverse correlation between the 3'UTR length and the site density. Sorting the genes according to their 3'UTR length (in increments of 400 bases) revealed the statistical difference ($P<0.005$ and less) between the neighboring groups along most of the 3'UTR length. Furthermore, we observed the statistically significant ($P<0.05$) differences between microRNA-binding sites in oncogenes and tumor suppressor genes within the 6401-7200 nucleotide segments of the 3'UTRs. The results suggest the influence of the selection pressure on the microRNA target site distribution and the functional importance of homologous microRNA-binding sites. The different distribution of the microRNA-binding sites in oncogenes and tumor-suppressor genes should be further studied in human pathology.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Talking Turtles.** Ethan Jones, Troy University; Fisher Parrish, Troy University; Elizabeth Kobs, Troy University; Alvin Diamond, Troy University.

Successful wildlife management requires basic demographic information on species present and the dimensions and dynamics of population change within those species. We initiated a mark–recapture survey of freshwater turtles in an isolated urban pond on the campus of Troy University in Pike County, Alabama to establish a long-term monitoring program. Mullis Pond is a 1 ha manmade impoundment constructed in the 1950's that is spring fed and receives significant urban runoff. We sampled from April -November 2024 using both small and large funnel traps baited alternately with cat food and peanut butter, as well as basking floating traps. Carapace length and width, plastron length, weight, sex, and species were recorded for each individual as well as trap type, and capture date. Each individual was marked for future identification by notching the marginal scutes on the carapace following the protocols of the North American Code, and photographed. Our study documented three species from the pond that correspond to observations on iNaturalist, while 2 species reported on that database have not thus far been documented by trapping.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Antibiotic activity of whole-cell and cell-free culture supernatant of a Paenibacillus species.** Cameren Cunningham, Auburn University in Montgomery; Adrian Lewis, Auburn University at Montgomery; Jecayla Howard, Auburn University at Montgomery; Madison Foshee, Auburn University at Montgomery; Benedict Okeke, Auburn University at Montgomery.

The increasing resistance of microbes to antibiotics is a serious public health problem. Antibiotics include natural microbial products, and other synthetic products that inhibit or inactive microbes. They were originally from microbial sources, but synthetic products with similar activity are also as antibiotics. Natural evolution in soil environments can lead to the emergence of unique antibiotic-producing strains. Thus, in this study, we screened microbes isolated from soil samples for antibacterial activity on both Gram positive and Gram-negative bacteria. One isolate was identified by 16s rRNA gene sequence analysis as Paenibacillus species C21 (99% identical to Paenibacillus polymyxa). Whole cells of Paenibacillus species C21 displayed antibacterial activity against Staphylococcus aureus and Citrobacter freundii. Further studies on the spectrum of antibacterial activity of cell-free culture supernatant of Paenibacillus species C21 are in progress.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**An Ancient Sulfide-Binding Free-Cysteine Motif Is Present in Three Extracellular Globin Genes in the Unique, Sulfide-Tolerant Limnodrilus hoffmeisteri (Annelida: Clitellata: Tubificida: Naididae), Blount Springs, AL, But Is Absent for One Gene in Freshwater Members of the Same Species.** Kayleigh Simpson, Samford University; Emma Thompson, Samford University; Shiloh Nokes, Samford University; Hannah Sanavi, Samford University.

We discovered a unique Tubificine worm surviving in the high-sulfide waters of Blount Springs (BSp), AL in 2013. This Annelid is a member of the very common, cosmopolitan species complex Limnodrilus hoffmeisteri, which recently was divided into ten cryptic species (I through X). The BSp worm is most likely a member of Clade III. The worm represents a range extension of Clade III (the only other Clade III populations are found in Illinois, USA, and in Belgium) and is also a habitat extension, since all other known members of the entire L. hoffmeisteri species complex live in freshwater. Using our recent BSp worm's de novo transcriptome data, we have identified several expressed extracellular globin genes that potentially have a sulfide-binding free cysteine in a motif found in sulfur-dwelling worms throughout the phylum. In this study, we PCR amplified and sequenced the potential sulfide-binding region of three of these globin genes in the BSp L. hoffmeisteri and in the other members of Clade III. Our results confirm that the BSp worm has this apparently ancient, free cysteine. For both the Illinois and Belgium Clade III worms, the sulfide-binding cysteine of one of the three genes is replaced by a serine, indicating that this gene might play a role in the BSp worm's sulfide tolerance. However, the putative sulfide-binding free cysteine for the two other genes is found in all three Clade III worms: the sulfur-dwelling BSp worm as well as the Illinois and Belgium freshwater worms. We plan to compare the data from these three worms with those from globins of the only other member of the genus Limnodrilus known to survive in high-sulfide waters, Limnodrilus sulphurensis, as well as with members of closely related L. hoffmeisteri clades.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**A Unique Alabama Sulfide-Tolerant Worm, Limnodrilus hoffmeisteri Clade III, (Annelida: Clitellata: Tubificida: Naididae) Begins To Yield Its Extremophile Secrets: Remnants of an Ancient Adaptation Rather Than Convergent Evolution?** David Johnson, Samford University.

In 2013, we discovered a Tubificine worm living in the effluent waters of Blount Springs (BSp), AL, in what should be a toxic sulfide concentration. Our 2022 publication of sequencing and morphological work showed this worm to be a member of the cosmopolitan species group Limnodrilus hoffmeisteri and most likely a member of Clade III. It has been proposed that L. hoffmeisteri is actually made up of ten cryptic species, but only the BSp worm lives in sulfur water and only one other member of the genus, Limnodrilus sulphurensis, survives in comparably high sulfide concentrations. In that previous publication, we proposed that these two sulfur tolerant outliers represent independent acquisition of that trait -- that is, they are an example of convergent evolution. An alternative hypothesis is that, in the early earth's sulfide environment, all Annelids were sulfur tolerant and that the majority of today's Annelids, absent the selective pressure of high sulfides, have lost that trait. If this alternative hypothesis is true, one possible mechanism of sulfide tolerance is the presence of sulfide-binding free cysteines in annelid extracellular globins, which is seen across the phylum in sulfur-tolerant worms. Our 2022 de novo transcriptome data of the BSp L. hoffmeisteri have identified several expressed extracellular globin genes that might have the conserved free-cysteine motif responsible for sulfide binding. I will discuss the details of these genes and globins in the BSp worm, their phylogenetic relationship to known Annelid sulfide-binding globins, and the overall implications for the evolution of sulfide tolerance in Annelids.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Investigate the effect of mutagenesis of the N-terminal residues on the Thermal stability of LDH.** Kayla Williams, Jacksonville State University; Sharifah Albraiki, Jacksonville State University.

Abstract:

Recent scientific studies have shown the enzyme, lactate dehydrogenase (LDH) has been used in discovering amino acid substitutions that lead to thermal stability. The amino acid sequences of orthologs of the enzyme LDH from five barracuda species (genus Sphyraena) have been compared with the Michaelis – Menton constants [Km] for substrate pyruvate and cofactor (NADH) that is dependent on different temperatures. As the temperature of the enzyme increases, the Km significantly increases as well among orthologs.

However, previous studies have shown that the changes of polar amino acids into non-polar amino acids in sequence at sites 11, 61, 121, and 181 is responsible for the differences in thermal stability between the LDH of S. argentea and S. lucasana. S. argentea is also different at the same sites from S. idiastes. All suggesting that evolutionary adaptation of proteins results from minor sequence modifications at positions outside the active sites, of which these altercations may affect the kinetic function and thermal stabilities of proteins independently. Despite this, we have yet to understand which amino acid substitution is responsible for the adaptation to temperature of LDH protein across different species.

We hypothesis that thermal adaptation is a result of minor changes in the amino acid sequence at specific sites in the N terminal. Thus, we plan to investigate the effect of an amino acid substitution of the N-terminal region on the thermal stability of the LDH protein in two different species (human and barracuda). To accomplish this, a Site-Directed mutagenesis experiment will be performed. Followed by a purification of the wildtype and mutant versions of LDH before performing kinetic assays to determine thermal stability.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Lowering the Barriers to Automated Cell Biology Experiments.** Scottland Cooper, University of South Alabama; Dhananjay Tambe, University of South Alabama.

The potential economic cost of irreproducibility in biology research is between $10B and $50B. A significant portion of this loss can safely be associated with experiments involving cultured cells. Pipetting, an extremely critical yet repetitive procedure in cell biology, for a small-scale laboratory has remained unchanged for nearly fifty years; The invention of automated pipetting devices, although alleviating the need for training and manpower, pose an entirely different burden of financial toll. By utilizing compressed air, one of the most ubiquitous resources within a laboratory, the issues of cost, automation, and even contamination have been answered; The proof-of-principle device is called the AirDropper. Built using low-end pneumatic devices and a low-power microcontroller and functioning through the Venturi principle, the necessary components purchased individually would cost a lab less than $100. The current version can aspirate and dispense at a flow rate of ~1 ml/sec or slower and a volume of ~50 µl or larger. In data collection and calibration, the errors in volume of dispensed fluid were comparable to the standard error in the weight of centrifuge tubes used to conduct the testing. By applying the principles of fluid mechanics, several parameters of the system that can improve accuracy and resolution of the amount of liquid dispensed have been identified and implemented. Eventual objectives include further optimization and laying groundwork for the standardization of the device.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Molecular Characterization of Lactic Acid Bacteria and Yeast from Local Fruits and Vegetables.**

Madison Foshee, Auburn University in Montgomery; Madison Foshee, Auburn University in Montgomery; Adrian Lewis, Auburn University in Montgomery; Tikayla Barker, Auburn University in Montgomery; Jecayla Howard, Auburn University in Montgomery; Cameren Cunningham, Auburn University at Montgomery; Benedict Okeke, N/AAuburn University in Montgomery.

Lactic acid bacteria (LAB) and yeasts are useful due to their probiotic properties and fermentation capabilities. Benefits of LAB include food nutritional value enhancement, intestinal pathogen control, immune system support, and antioxidant properties. In addition to the use of yeasts in fermentation, some yeasts produce carotenoid pigments which have industrial applications. This study focused on the isolation of LAB and yeast strains from local fruits and vegetables (Blueberry, Blackberry, Purple Plum, Okra, Tomato, Mixed Plum, Green Plum, Black Plum, Watermelon, Pineapple, Banana Pepper) obtained from farmers markets in Montgomery, AL. Samples taken from the internal portion of each fruit were minced in sterile normal saline and serially diluted (10^1 to 10^5). Aliquots of the dilutions were plated on De Man, Rogosa and Sharpe (MRS) agar for lactic acid bacteria and on malt extract agar (MEA) for yeasts. Lactic acid bacteria were incubated in an anaerobic jar, while yeasts were incubated aerobically. Lactic acid bacteria were identified by 16S rRNA gene sequence. Yeasts were identified using the ITS region DNA sequence. GenBank BLAST revealed the following identities for the isolates: BLU 1 (Latilactobacillus sakei), BLU 2 (L. Sakei), BLA 1 (Paenibacillus ourofinensis), BLUY 2 (Sporidiobolus pararoseus), PINY 2 (Rhodotorula mucilaginosa), OKRY 2 (S. pararoseus) and RPY 1 (S. pararoseus). Further work is focusing on antioxidant and antibiotic activities of the isolates.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Unequal Distribution of microRNA Target Sites within 3'UTR: Implications for Evolutionary Genomics and Bench to Bedside Research.** Alexander Kofman, Troy University; Franziska Ahrend, National Institute of Diabetes and Digestive and Kidney Diseases; Walter Bell, The University of Alabama at Birmingham; Jiling Zhong, Troy University; Long Ma, Troy University; Vitaly Voloshin, Troy University; Siegfried Harden, Trpy University.

Mammalian microRNAs interact with their mRNA target sites and trigger translational repression. MicroRNA-binding sites are found in the mRNA protein-coding region and even in the 5'UTR. However, most of the functional microRNA target sites are positioned within the mRNA 3'UTR, whose impact on the fine-tuned regulation of gene expression is still to be elucidated. Using the original software tools, we analyzed the location of the predicted microRNA-binding sites within the 3'UTRs of about 4000 human mRNA sequences retrieved from the TargetScanHuman 8.0 (7- and 8mers sites) and NCBI (6mers sites) databases. We found a very strong correlation between the length of the 3'UTR sequence and the density of homologous (repeated) microRNA-binding sites, whereas the regular sites were characterized by the inverse correlation between the 3'UTR length and the site density. Sorting the genes into the groups according to their 3'UTR length (in increments of 400 bases) revealed the statistically significant difference in microRNA target site densities between the neighboring datasets for both the regular and homologous sites. Furthermore, we observed the statistically significant difference between the homologous microRNA target site density in oncogenes and tumor suppressor genes with the 3'UTR length of 6401-7200 nucleotides. The results suggest the selection pressure on the microRNA target site distribution along the 3'UTR and the functional importance of homologous microRNA-binding sites. The differences in the positioning of the homologous microRNA target sites in oncogenes and tumor-suppressor genes with the long 3'UTRs ought to be further studied in human pathology.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Combination of HDAC and FYN inhibitors in Synovial Sarcoma Treatment.** Gavin Anchondo, Jacksonville State University; Gavin Anchondo, Jacksonville State University; Le Su, Jacksonville State University.

The SS18-SSX fusion protein is an oncogenic driver in synovial sarcoma. At the molecular level, SS18-SSX functions as both an activator and a repressor to coordinate transcription of different genes responsible for tumorigenesis. Here, we identify the proto-oncogene FYN as a new SS18-SSX target gene and examine its relation to synovial sarcoma therapy. FYN is a tyrosine kinase that promotes cancer growth, metastasis and therapeutic resistance, but SS18-SSX appears to negatively regulate FYN expression in synovial sarcoma cells. Using both genetic and histone deacetylase inhibitor (HDACi)-based pharmacologic approaches, we show that suppression of SS18-SSX leads to FYN reactivation. In support of this notion, we find that blockade of FYN activity synergistically enhances HDACi action to reduce synovial sarcoma cell proliferation and migration. Our results support a role for FYN in attenuation of anti-cancer activity upon inhibition of SS18-SSX function and demonstrate the feasibility of targeting FYN to improve the effectiveness of HDACi treatment against synovial sarcoma.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Comfort expressing identity among sexual and gender minority adults in the Deep South.** Taylor Miller. Riley Luthin, University of Alabama at Birmingham.

Background: Sexual and gender minorities (SGM) experience disparities in health due to higher levels of stress attributed to their minority status. Considering restrictions on healthcare access to the LGBTQIA+ community, we aimed to identify comfort with sexual orientation and gender identity expression among SGM adults living in the US Deep South.

Methods: Via electronic survey, adults 18y+ living in Alabama were asked basic demographic questions related to age, sex, race, sexual orientation, and gender identity. Participants were also asked to rate their comfort with their sexual orientation and gender identity expression. Finally, only those self-reporting as SGM were asked to rate their stress level due to their LGBTQ+ identity.

Results: 222 participants completed the survey. Most of the sample identified as cisgender, ~34% participants identified as gender minority. Yet, the majority (~78%) identified as sexual minority. Generally, participants felt comfortable with expressing their gender identity (60.8%) and sexual orientation (66.2%). Yet, transgender males (OR=0.27, p=0.05), transgender females (OR=0.23, p<0.01), and those identifying as other gender (OR=0.23, p<0.001) were significantly less likely to be comfortable with gender identity expression compared to cisgender participants. Bisexual (OR=0.06; p<.001), gay (OR=0.13; p<0.01), lesbian (OR=0.17; p<0.01), or those identifying as other sexual orientation (OR=0.07; p<0.001) were significantly less likely to be comfortable with sexual orientation expression compared to heterosexual participants. Transgender females expressed the most stress related to their LGBTQ+ identity (61.1%), followed by transgender males (41.7%) and other gender (35.6%) compared to cisgender participants including those that identified as sexual minority.

Conclusion: SGM adults living in the Deep South experience reduced comfort in expressing their minority identity, with gender minority adults experiencing the most discomfort. Stress resulting for one's LGBTQ+ identity is also highest among transgender and other gender identifying adults suggesting that gender minorities should be a key focus for mental health support.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Melt-curve Analysis as a Tool for Bacterial Community Profiling.** Ryan Standaert, University of Alabama at Birmingham; James Morris, University of Alabama at Birmingham.

Lab-grown mixed cultures containing multiple bacterial strains are a standard microbiological technique used to assess relative fitness between potential competitors. In these, and similar assays, the positive identification of strains, as well as their relative abundances, are important variables in assessing community composition. Next-generation sequencing has been used extensively to profile bacterial communities, but is time-consuming and involves additional sample preparation. High-Resolution Melt-curve Analysis (HRM) has been explored as an alternative which does not rely on sequencing, but instead differentiates DNA sequences based on the denaturation temperature of PCR products. HRM approaches have been used to identify isolated strains of bacteria in clinical infections, especially in combination with digital PCR, as well as to determine copy numbers of targeted alleles utilizing competitive PCR, but to our knowledge have not successfully been used to determine both identity and relative abundance of bacterial strains in mixed cultures without the use of specialized primer sets. Consequently, we sought to develop a single-step HRM method for analyzing bacterial community composition utilizing a standard commercial master mix and universal 16s rRNA primers. In our proof-of-concept, we combined laboratory bacterial strains at a range of concentrations, and attempted to determine strain identity and relative abundance from melt-curves of the combined samples. Our results suggest that melt-curve analysis may provide a fast diagnostic tool for identifying bacterial strains present in lab-grown mixed cultures.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Role of Calcium sensitive RabGAPs in endocytic trafficking pathway.** Amelia Herron, University of Alabama at Birmingham; Zhiyong Liu, University of Alabama at Birmingham; Heng Huang, University of Alabama at Birmingham; Jerry Law, University of Alabama at Birmingham.

Rab GTPases are master regulators of endocytic and secretory pathways. The activity of Rab GTPases is tightly regulated cascade depends on guanine nucleotide exchange factors (GEFs) and GTPase-activating proteins (GAPs). Rab GAPs facilitate Rab dissociation from membranes, ensuring proper boundaries and transition of different membrane compartments during trafficking. Dysregulation of Rab-GAP activity has been shown to disrupt the Rab-cascades and cause impairment of endocytic and secretory pathways. A fundamental yet unresolved question is how the precise spatial and temporal activation of Rab GAPs is regulated. In this study, we identified a novel RabGAP, namely TBC1D9B, which contains an EF-hand calcium-sensing domain. Of note, calcium flux, regulated by calcium channels, has been implicated in various membrane trafficking pathways, including endocytosis, exocytosis, and endolysosomal fusion. To evaluate whether TBC1D9B functions as a bona fide Rab10 GAP and whether its GAP activity is dependent on $Ca^{2+}$, we performed a GTP hydrolysis assay using purified recombinant TBC1D9B and Rab10 proteins. Our findings demonstrated that TBC1D9B exhibited robust GAP activity toward Rab10 only in the presence of calcium. Additional immunofluorescence staining suggests that TBC1D9B is primarily localized on endolysosomes in neurons and macrophages, indicating that TBC1D9 may sense calcium signal on these subcellular organelles to control downstream Rabs. Importantly, EF-hand-containing Rab GAPs are implicated in diseases such as nephrotic syndrome, breast cancer, and Alzheimer's disease, underscoring the broad disease-relevance of these pathways. This research could shed light on how dysregulation of calcium-dependent GAP activity contributes to the pathogenesis of a variety of diseases.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Boosting Mobility: Impact of Lactobacillus plantarum and Its Byproducts in a Fruit Fly Model of Alzheimer's Disease .** Yousef Addassi, Samford University; Harrison Taylor, Samford University; Alexa McDermott, Samford University; Maddi Roberts, Samford University; Patricia Jumbo, Samford University; Brad Bennett, Samford University .

Background

Lactobacillus probiotics have demonstrated therapeutic potential in Alzheimer's disease (AD) by modulating the gut microbiome, while Lactobacillus postbiotics- the soluble factors secreted by live bacteria- confer similar effects with added advantages like longer shelf life, lower cost, and reduced infection risk. Evidence of the postbiotics' benefits in AD is limited. This study compares the effectiveness of Lactobacillus probiotics and postbiotics in mitigating behavioral deficits in a Drosophila AD model.

Methods

Flies overexpressing human amyloid β precursor protein and β-site APP cleaving enzyme in neurons served as AD models. Lactobacillus plantarum (Lp) was prepared at 1.0 x $10^9$ CFU/µL, with the upper 80% of culture supernatant filtered as postbiotic fraction (Lp-PBx). Lp and Lp-PBx were diluted 1:2 in 5% sucrose and administered via capillaries in four 24-hour doses over two weeks. Mobility was assessed using a negative geotaxis assay testing flies' ability to cross 8-cm in 10 seconds. Data were analyzed via two-way ANOVA, testing effects of genotype, treatment, and their interaction.

Results

Untreated AD males and females exhibited significant mobility impairments compared to controls. However, AD flies fed Lp or Lp-PBx showed restored mobility, climbing at speeds comparable to controls. Specifically, AD males fed Lp (0.73±0.03) or Lp-PBx (0.75±0.03) and females fed Lp (0.61±0.04) or Lp-PBx (0.59±0.04) climbed significantly faster than untreated counterparts (males: 0.48±0.03; females: 0.39±0.04). Regardless of genotype, males consuming Lp ate significantly less than Lp-PBx-fed males (p=0.0216).

Conclusion

In conclusion, Lp and Lp-derived postbiotics were equally effective in mitigating locomotive deficits in AD flies.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Acoustic Survey of Bat Community on Fort Moore.** Kaitlin Connelly, Auburn University; Jean Fantle-Lepczyk, Auburn University; Robert Gitzen, Auburn University.

Bats are declining at an unprecedented rate in the United States, due to disease, habitat destruction, and invasive species, amongst other threats. In response to the need for increased understanding of the bat community, Fort Moore asked researchers at Auburn University to provide an acoustic survey of bats on the installation in the summer of 2023. The soon-to-be Endangered Species Act listed tricolored bat (Perimyotis subflavus) was a particular focus as populations have declined by >90% throughout portions of its range. Presence/absence of bats on Fort Moore was assessed via two methods: passive acoustic monitoring of 47 sites across the installation and two mobile survey routes. 2,147,494 file sequences were recorded across 1,274 site-survey nights and were initially analyzed through automatic identification by Kaleidoscope. Confirmation by expert vetters showed the auto-id results had a significant error rate. On average, we detected 5.5 species at each site (range 1-8). An additional five species were provisionally detected across the installation, four of which are federally protected or under review for listing. Tricolored bats were one of the most common, making up ~25% of all auto identified calls, and we confirmed their presence at 45 passive monitoring sites and on both mobile survey routes. Overall, Fort Moore appears to have a suitable community of bats using the installation, with a particularly high frequency of tricolored bats.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Changes in Synaptic Tau Levels and Dendritic Spine Morphology in Alzheimer's Disease.** Juliana Eberhardt, University of Alabama at Birmingham.

Cognitive decline in Alzheimer's disease (AD) correlates well with the extent of tau pathology and synapse or dendritic spine loss. Thus, studying synaptic processes may aid in the identification of new therapeutic targets that limit cognitive decline. The entorhinal cortex (EC) is an initial site of tau tangle formation, from which tau can propagate to other brain regions like the hippocampus and prefrontal cortex (PFC) through synaptic connections. We developed a pipeline whereby dendritic spine density and morphology as well as synaptic tau measurements from the EC were incorporated into a correlation network to identify relationships between spine morphology and synaptic tau in AD patients. Golgi-stained dendrites and dendritic spines from postmortem human BA28 EC were imaged using high-resolution brightfield microscopy and digitally reconstructed in 3D for morphometric analysis. Synaptosome fractions were isolated from the same BA28 samples. Levels of synaptosome and insoluble phosphorylated tau were measured by ELISA. Dendritic spine density in the EC is reduced in AD, but not in cognitively normal individuals with AD pathology (CAD) cases. This was also seen in the PFC of the same cases. AD cases exhibit more synaptosomal pS396 tau in the EC than CAD cases. Next, we compared our findings in humans with rodent models of AD, including the humanized tau (htau) mice. Overall, our studies reveal notable relationships between levels of phosphorylated tau and dendritic spine morphology in both mice and humans.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Engineering of For-Profit Drought Tolerant Crops; the circadian rhythmic overexpression of RD29s In transgenic plants.** Adhikari Ashna, Auburn University; Simrandeep Kaur, Auburn University; Sang-Wook Park, Auburn University.

Our goal is to develop 'commercial grade' crop cultivars that enhance tolerance to drought without compromising growth and yield potentials in standard conditions. Drought is the costliest and most destructive environmental stress. For decades, a large number of studies have devoted to identifying Drought Tolerance Genes (DTGs) for various plant species, and pursued via numerous breeding and engineering approaches. However, the efforts produced few results. A major challenge was that the new cultivars tend to suppress critical aspect of plant growth and development. To combat this, we develop a novel method to co-regulate DTG and plant growth gene expressions, which allows plants to concomitantly run 'growth and defense' machineries for enhancing drought stress response without yield penalties. Thus, this proposal will help establish a novel avenue to release 'for-profit' drought tolerant crop cultivars in markets.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Type 4D cAMP-Phosphodiesterase (PDE4D) as a Novel Therapeutic Agent in Obesity.** Zachary Chancey, University of South Alabama; Jackson Miller, University of South Alabama; Daniel Irelan, University of South Alabama; Abigail Boyd Boyd, University of South Alabama; Edward Fielder, University of South Alabama; Will McDonald, University of South Alabama; Wito Richter, University of South Alabama.

The cAMP-phosphodiesterase 4 (PDE4) family comprises four genes, PDE4A, B, C, and D. Treatment with non-selective/PAN-PDE4 inhibitors induces weight loss and improves glucose

homeostasis in humans and animals, suggesting a therapeutic potential of targeting PDE4s in obesity and metabolic syndromes. However, these drugs also produce adverse effects which limit their clinical utility. Conversely, targeting individual PDE4 subtypes is a promising approach to isolate the therapeutic benefits from the adverse effects of current PAN-PDE4 inhibitors. Prior research has shown that mice with a global genetic deletion of just one PDE4 subtype, PDE4D

(global PDE4D-knockout mice), mimic the metabolic phenotype produced by PAN-PDE4 inhibitor treatment, including reduced body weight and adiposity, and improvements in blood

glucose- and lipid homeostasis. However, global PDE4D-knockout mice exhibit development delays at birth (they are runts at birth), opening the possibility that the lack of 4D during fetal development may contribute to or predispose toward the metabolic phenotype of the mice. To address this issue, we utilized a novel mouse model that employs the CRE/loxP system for the timed ablation of PDE4D upon treatment of adult mice with tamoxifen. Our results reveal that following treatment with tamoxifen, induced PDE4D ablation in adult mice replicates the core features of global 4D-KO mice, including reduced body weight and adiposity, and improved glucose homeostasis. These findings suggest that starting PDE4D inactivation in adulthood is sufficient to produce metabolic benefits and may, thus, be pursued as a therapeutic approach in obesity and metabolic syndromes.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Human breast milk-derived exosomes attenuate lipopolysaccharide-induced activation in microglia.**
Oluwatomi Akinduro, University of Alabama at Birmingham; Sanjay Kumar, University of Alabama at Birmingham; Yuechan Chen, University of Alabama at Birmingham; Quamarul Hassan, University of Alabama at Birmingham; Brian Sims, University of Alabama at Birmingham.

Microglia mediate the immune response to many insults in the central nervous system, including lipopolysaccharide (LPS), a bacterial endotoxin that initiates an exaggerated neuroinflammatory response in neonates, especially preterm infants. Exosomes, which are nanosized vesicles (40–150 nm) involved in intercellular communication, are implicated in many pathophysiological processes through the effects of their highly regulated cargo. Human breast milk, which is rich in exosomes, plays a vital role in neonatal immune system maturation and adaptation. Activated microglia may cause brain-associated injuries or disorders, especially in the hyperinflammatory response that commonly occurs in the immature neonatal immune system. Therefore, safe and effective options are vital and urgently needed for this susceptible population. We hypothesize that human breast milk-derived exosomes (hBME) attenuate LPS-induced activation of microglia by decreasing p38 MAPK and NF-kB p50/p65 phosphorylation downstream of TLR4 in microglia. We isolated hBME and characterized them using nanoparticle tracking analysis, transmission electron microscopy, fluorescence-activated cell sorting, and western blot analysis. Biochemical analysis of microglia exposed to LPS and hBME indicated that hBME modulated the expression of signaling molecules in the canonical NF-kB pathway, including MyD88, IkBa, p38 MAPK, NF-kB p65, and their products CD40, NLRP3, and cytokines IL-1b and IL-10. Immunocytochemistry analysis showed hBME-mediated inhibition of morphological changes consistent with microglial activation and downregulation of proinflammatory markers, CD40 in BV2 and Iba-1 in HMC3 microglia. Here, we present hBME as a novel, biologically safe, easily accessible, and reproducible therapeutic option for attenuating the microglial response to LPS in neonates.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Investigating the Antimicrobial Potential of Lactobacillus plantarum Postbiotics Against Enteric Bacteria.** Maddi Roberts, Samford University; Alexa McDermott, Samford University; Patricia Jumbo-Lucioni, Samford University; Brad Bennett, Samford UniversitySamford University.

Probiotics such as Lactobacillus plantarum can be found naturally in many types of fermented foods and beverages and cultures are added to dairy products to encourage yogurt production. Once consumed, probiotics can provide a myriad of human health benefits, including improved carbohydrate breakdown, vitamin production, and barrier protection against pathogens in the gut. Postbiotics, small molecules and proteins secreted by probiotics, may also impart important benefits. The objective of this study was to determine whether the postbiotic fraction from L. plantarum has inhibitory effects on the growth of both BSL-2 gram-negative and gram-positive pathogenic enteric bacteria. If so, it would suggest postbiotics are sufficient for the barrier protection qualities ascribed to probiotics. L. plantarum strain ATCC 14917 was cultured, and the postbiotic fraction was extracted through a series of centrifugations and filtrations. This was used to conduct replicate disc diffusion inhibition assays with Escherichia coli strain O157:H7 and Staphylococcus aureus. The postbiotic stock and two dilutions (1:10 and 1:100) were used, and zones of inhibition (ZOIs) were measured and recorded for each assay. No inhibition of growth was observed for S. aureus, whereas measurable ZOIs could be recorded for E. coli on all plates with the postbiotic stock. These results suggest that L. plantarum postbiotic may exhibit selective antimicrobial activity against gram-negative pathogens, but not against gram-positive pathogens, as has been reported in previous studies.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**The Nucleotide Content of the 3'UTR in Human mRNAs.** Alexander Kofman, Troy University; Morgan Seymour, ; Giulianna Rivero, ; Kenaz Knowles, ; Brayden Varnado, ; Mary Katherine Swanson Lee, ; Loren Belle Evans, .

The functional microRNA targets, which are considered to be key cis-acting regulatory elements, are positioned within the mRNA 3'UTR. The presence of cis-acting elements may be related to the specific nucleotide content of the gene fragment. We analyzed the nucleotide content of the 3'UTRs of the 186 human mRNAs (NCBI database). Our results indicate that G-C content is lower within 3'UTR as compared to the whole mRNA sequence. Furthermore, we found a moderate negative correlation between the G-C% and the length of the short (500-1400) 3'UTRs. It can be explained by the presence of the polyA tail within the 3'UTR at the very end of the mRNA. However, according to our data, the lower G-C% is due to the decrease of the C%. To further elucidate the impact of the 3'UTR on gene expression, more studies are needed to explore the nucleotide content within the 3'UTR of various lengths and compare the results with the distribution of the microRNA-binding sites.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Effects of diet types on Daphnia pulex longevity and reproduction.** Ola Lutfi, University of Alabama at Birmingham; Victoria Gibbs, University of Alabama at Birmingham.

The model organism Daphnia pulex, a freshwater crustacean with a lifespan of approximately 60 days, is being used to understand the effect of different diets on longevity and health. Currently, no standard diet is followed by laboratories using D. pulex but most use live algae strains like the unicellular green algae Raphidocelis subcapitata. Live strains, however, require careful culturing practices and are susceptible to contamination and inconsistent nutritional composition. Non-living algal concentrates with more consistent nutrient profiles and easy storage and preparation are now commercially available and used for many aquaculture species. In this experiment, we tested three different diets, one live algal and two Reed Mariculture concentrates, all of which have been used as a food source in labs for D. pulex studies. Neonates (<24 hrs. post-hatching) from three different clonal D. pulex mothers were separated into individual vials (n=5 individuals per clonal line per treatment). Vials were checked daily for the presence of neonates and living status of individual mothers while water changes were completed Mondays, Wednesdays, and Fridays. Then, individuals were fed either R. subcapitata (2.36x10^6 cells/ml), or a 1:10 dilutions of either RG Complete (6.53x10^6 cells/ml) or Shellfish Diet (2.03x10^5 cells/ml). A log rank test (p=0.68) revealed that lifespan curves across all groups were not significantly different. The average total offspring for an individual was greatest in the Shellfish Diet treatment at 86. The body size for individuals fed RG complete was smaller than those fed green algae or Shellfish Diet.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Heart Rate Measurement of Daphnia pulex in Lifespan Studies.** Gabriel Coleman, University of Alabama at Birmingham; Victoria Gibbs, University of Alabama at Birmingham.

The water flea, Daphnia pulex, serves as a proficient model in lifespan studies due to its short lifespan, rapid reproduction rate, and transparency of the body wall. The heart rate of D. pulex can be easily observed and serves as a metric of health. The objective of this study is to discover if measuring the heart rate of D. pulex jeopardizes their lifespan. Two groups of fifteen D. pulex neonates (n = 5 individuals/clonal line x 3) were isolated in individual 60mL vials. The undisturbed (control) group and heart rate group were monitored for reproductive rates and lifespan, and in the latter group, heart rate measurements were taken at two, four, and six weeks. A Leica Ivesta 3 microscope and camera were used to capture videos. D. pulex was mounted to the microscope and was kept stationary by cotton strands and a droplet of water. After it slowed its movement (30 secs- 2 minutes), three, 15-second videos were captured, and the Daphnia was returned to its vial. The steps were repeated for each organism. The results show no apparent difference in reproduction rates or lifespan between the undisturbed and heart rate groups. The average heart rate for each clonal line at 2 wks old (444 to 498 bpm) was lower than that observed in 6 wk old individuals (460 to 543 bpm). Since no apparent differences were observed for reproduction rate or lifespan, it appears that heart rate can be measured for D. pulex individuals as an additional healthspan metric.

(Keywords: animal model, heart rate, healthspan)

I. BIOLOGICAL SCIENCES

A Poster Presentation

**#NAME?.** Rebecca Iglesias, University of Alabama at Birmingham; Victoria Gibbs, University of Alabama at Birmingham.

Daphnia pulex is an effective animal model for aging biology studies because of its small size, transparency, and ability to reproduce through parthenogenesis. To determine the health of the organism at a given age, particularly when performing lifespan and healthspan studies, a series of health metric tests can be given. Oxygen uptake rates are one of these metrics, which can be used to calculate metabolic rates in models and determine changes in metabolism across an organism's lifespan. This experiment was performed in an effort to find to understand the relationship between diets and the oxygen uptake rates of D. pulex. Neonates (< 24 hrs post hatch) from three different clonal lines were allocated into one of three groups. One group was fed a live, unicellular green algae, Raphidocelis subcapitata, the other groups were fed a non-living algae concentrate, either Shellfish diet or R.G. complete (Reed Mariculture). All groups were fed their designated diet every Monday, Wednesday, and Friday. At 2 weeks old and 4 weeks old, four randomly chosen individuals from each group were placed in a 200 µL well-plate of a microrespirometry system (Loligo Systems, Denmark) and oxygen uptake rates were measured every 15 seconds for 45 minutes. Oxygen uptake rates were similar at both ages for individuals fed green algae (248 pmol O2/min) or Shellfish Diet (237 pmol O2/min) but were lower for individuals fed RG Complete (100 pmol O2/min). Individuals fed RG Complete were also smaller in size, which may explain the differences in oxygen uptake observed.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**MIXED METHODS AND MURKY MICROBIOMES: A LITERATURE REVIEW OF CURRENT MICROBIAL PROFILES AND ASSOCIATED CHALLENGES IN SEA URCHIN STUDIES.** Skyler Oliver, University of Alabama at Birmingham; Michael Williams, University of Alabama at Birmingham; Jeri Brandom, University of Alabama at Birmingham; Asim Bej, University of Alabama at Birmingham; Stephen Watts, University of Alabama at Birmingham .

With the rise in demand for commercial fisheries and marine invertebrate cultivation, understanding the biological needs of aquatic organisms for optimal health and growth has become critical. Sea urchins, valued for their biomedical research as model animals and cultured seafood, are increasingly studied for commercial and scientific purposes. The microbiomes - the living communities in the gut ecosystem of urchins, play a crucial role in echinoid health, influencing nutrition and metabolism.

While recent technological advancements have improved the accessibility of these microbiomes and made studying their effect on hosts logistically feasible, a lack of standardization has led to inconsistent methodologies in sample collection, dissection, experimental controls, genomic library preparation, and data analysis through informatic pipelines. Addressing these inconsistencies is essential to unlocking the full potential of microbiome research for enhancing urchin health and productivity.

At present, meaningful comparisons across urchin microbiome studies are challenging. This review aims to consolidate the current findings of the field, highlight differences in methodologies and reporting that contribute to variation across 16 studies involving 18 unique urchin species, and provide suggestions for standardizing methodologies and reporting for future studies. By focusing specifically on the gastrointestinal ecosystem and its associated microbiota, the standardization practices will help identify keystone and core taxa and their ecological roles in metabolic function, establishing a strong foundation for future ecological, biomedical, and nutritional sciences.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**The Impact of Urbanization on Microbial Communities Along Shades Creek.** Lily Flowers, Samford University; Harvey Sophia, Samford University; Drace Kevin, Samford University .

Urbanization and pollution are increasingly impacting environmental health, particularly through their effects on microbial communities in soil. Microbial communities are essential for maintaining ecosystem functions, such as nutrient cycling and soil health, and any disruption in their diversity and abundance can have serious ecological consequences. This study investigates how anthropogenic factors, specifically urbanization and pollution, affect the diversity, abundance, and antibiotic resistance of microbial communities in soil along Shades Creek in Birmingham, Alabama. This research question investigates whether areas with greater pollution exposure have reduced microbial diversity with increased antibiotic resistance compared to more natural environments. Soil samples were collected from four sites along Shades Creek, representing different levels of human activity. The results showed that urbanized areas exhibited lower bacterial diversity and abundance as compared to more natural environments. Higher antibiotic resistance was noticed evenly in both urbanized areas as well as natural environments. These findings suggest that direct human activity and pollution may limit microbial diversity, potentially disrupting ecosystem functions. This reduction in microbial diversity poses risks to soil health and ecosystem sustainability, emphasizing the need for further research to mitigate the impacts of urbanization on microbial communities.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Analysis of Local Bacteria in Blount Springs, AL.** Michael Mellinger, Samford University; Kevin Drace, Samford University.

Blount Springs, Alabama is home to numerous sulfur springs, and within the streams that flow from them, a diverse community of sulfur-oxidizing bacteria. Analysis of these species allows for further understanding of how bacteria oxidize sulfur in their various metabolic pathways. Water samples were collected and bacteria isolated in aerobic and anaerobic environments with agar that simulated the environmental conditions. Minimal growth of filamentous bacteria occurred on the anaerobic spring water plates. Genomic DNA was isolated from these isolates and the 16s rRNA gene was amplified and sequenced. BLAST results suggest that the filamentous bacteria belonged to the genus Sulfurospirillum with a homology of ~96%. These findings indicate that the Sulfurospirillum genus of bacteria play a role in this diverse microbial community. This preliminary study contributes to a deeper understanding of sulfur-oxidizing bacteria and their ecological roles in sulfur cycling in this unique environment.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Evaluation of Body Composition in Response to Single Cell Protein in Zebrafish.** M. Gibson Attar, University of Alabama at Birmingham; Jami de Jesus, University of Alabama at Birmingham; Jonathan Flowers, University of Alabama at Birmingham; Robert Barry, University of Alabama at Birmingham; Michael Williams, University of Alabama at Birmingham ; Jeri Brandom, University of Alabama at Birmingham; Stephen Watts, University of Alabama at Birmingham.

Zebrafish are an invaluable model for biomedical research. The development of a standard reference diet (SRD) optimizing growth, reproduction, and health profiles will further their use as a high throughput translational model and facilitate the definition of specific nutritional requirements for zebrafish. Protein sources included in our lab's SRD are fish protein hydrolysate (FPH) and casein (CAS). FPH, a fish meal derivative, holds exceptional nutritional value, but can fluctuate compositionally due to its wild-caught origins, impeding experimental rigor. Recent success from our lab using a bacterial-based protein source suggest its potential value as a component of an SRD. A protein source(s) optimizing health outcomes and stable in amino acid composition will further SRD development and experimental reproducibility. We evaluated the physiological impact of a commercially-produced, bacterial-based single cell protein (MRD-Pro, Meridian Biotech) when replacing FPH and CAS. Zebrafish were fed Brachionus and Artemia nauplii until 35 days post fertilization, then were fed ad libitum one of seven formulated experimental diets. Dual and sole source dietary protein sources were as follows: proposed SRD (FPH and CAS), MRD19 and CAS, MRD24 and CAS, autoclaved MRD24 and CAS, MRD24 alone, FPH alone, and CAS alone. Weights and lengths of the zebrafish were tracked every two weeks for 16 weeks. All diets supported growth, development, and fecundity. The SRD supported the greatest weight gain, and the single protein source diets supported the least weight gain. Funded by NIH STTR (9R42OD034188-02A 1).

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Weevil infestation patterns follow masting and drought in six oak species in central Alabama.** Hayden Ledford, Samford University; Arabella Hall, Samford University; Caroline Altman, Samford University; Trustin Northington, Samford University; Bella Spry, Samford University ; Ryan Taylor, Samford University; Emma Thompson, Samford University.

There are two major theories that account for the pulsed reproduction seen in oak masting: the weather hypothesis and the predator satiation hypothesis. The weather hypothesis suggests that masting is synchronized by shared regional weather patterns, while the predator satiation hypothesis proposes that non-mast years suppress seed predators, allowing large acorn pulses in mast years to escape predation and germinate. Acorn weevils, specialized acorn feeders with one generation per year, are a key seed predator. We studied acorn production and weevil infestation in 230 trees of six oak species in Birmingham, AL, over eight years. Weekly acorn counts were conducted in 3 $m^2$ plots under each tree each autumn. Results indicate that acorn production varies significantly by year and species, with drought years showing markedly lower yields. Infestation rates also vary by species and are higher in low-production years. These findings support the weather hypothesis, as oaks appear to synchronize masting based on regional environmental cues. Masting is somewhat coordinated across species, though exceptions occur. Drought significantly reduces acorn production, as observed in 2023 and 2024. Weevil infestation inversely tracks acorn production rather than responding directly to drought conditions. This suggests that both hypotheses contribute to oak masting dynamics, with weather influencing mast synchronization and predator satiation shaping seed survival and germination.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Endolysins as Natural Antimicrobial Agents for Mitigating Listeria monocytogenes to Enhance Food Safety.** Nikhat Sultana, Tuskegee University; Weaam Awad, Tuskegee University; David Donovan, Morgan State University; Archana Sharma, Tuskegee University.

The food safety pathogen Listeria monocytogenes (Lm) presents a significant challenge in the production and processing of ready-to-eat foods due to its environmental persistence and its ability to proliferate intracellularly and under refrigerated conditions. Bacteriophage-derived cell wall hydrolytic enzymes (endolysins), represent a promising antimicrobial intervention. The increasing consumer demand in Western countries for natural, preservative-free foods has further emphasized the need for innovative, effective, and natural food safety solutions. This abstract explores the significance of phage-endolysins and their pivotal role in mitigating Listeriosis caused by Lm. Endolysins show potential as antimicrobial agents and exhibit reduced development of resistant strains. This research involves the extraction and analysis of three Lm phage endolysins (Ply511, PlyP40, and PlyPSA) for their known efficacy against Lm at pre and post harvesting temperatures on spinach. These three enzymes are known to have broad spectrum effect against multiple pathogenic Lm strains. The goal is to develop safer and more sustainable food safety protocols, highlighting the critical role of endolysin-based strategies in modern leafy vegetable food production.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Investigating the Role of WNT Signaling in Morphogenesis and Mucin Secretion in Intestinal Crypt-Villi Formation Using Caco-2 Cells.** Osionela Ogiogwa, Alabama A&M University; Nathaniel Burmas, University of California, Irvine.

Morphogenesis is the crucial process by which cells can pattern into tissues and organs. To develop a desired model, this process needs to be precisely controlled. The WNT signaling pathway plays a vital role in many developmental processes, and it is hypothesized that it can control morphogenesis in the formation of many different tissues. This study aims to focus on the intestine, as the formation of crypt-villi is a modest process used to portray the control of morphogenesis in terms of functionality. It is also widely known that the intestine secretes mucin to protect itself; therefore, in vivo, crypt-villi will secrete mucin as a sign of a practical model of the intestine at the cellular level. Thus, exposure to different growth factors and inhibitors affecting the WNT signaling pathway can control the MUC expression in colorectal cancer cells (Caco-2). This secretion would be quantified via qRT-PCR, focusing on MUC2, MUC5A, and AXIN2 expression, proving that regulating the WNT signaling pathway controls the functionality and formation of the crypt-villi.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Bioinformatics Analysis of POGZ Variants in Relation to White-Sutton Syndrome.** Hannah Rollins, Jacksonville State University; Lauryn Staples, Jacksonville State University; Jenna Ridlen, Jacksonville State University .

White-Sutton Syndrome is a neurodevelopmental disease that results in physical abnormalities, intellectual disability, and in some cases, epilepsy. Using Simple ClinVar, two genes were discovered to have genes associated with White-Sutton Syndrome: POGZ and CLI3. POGZ is associated with sixteen missense variants of uncertain pathogenic significance, whereas CLI3 is only associated with a single variant of uncertain pathogenic significance.

POGZ was the gene chosen for this research due to it having a higher association with White Sutton Syndrome. POGZ is a gene that encodes for a protein involved in mitosis- specifically chromosome separation, sister chromatid cohesion, and kinetochore assembly. POGZ plays a critical role by managing different stages of mitosis. Mutations in POGZ disrupts functions of mitosis, which lead to developmental defects commonly leading to neurodevelopmental disorders such as intellectual disabilities, autism, and microcephaly. POGZ is located on loci 1q21.3, which is a region crucial for chromosome segregation and central to brain development and function.

This research will use several bioinformatics and protein modeling tools to ascertain the pathogenicity of variants. The results of this research will determine the pathogenicity of a POGZ variant of uncertain significance in relation to White-Sutton Syndrome.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**Genomic Analysis of Microbial Samples from Mars 2020 Rover Spacecraft.** Winner Igbogbo, Alabama A&M University .

The Mars 2020 Rover mission, spearheaded by NASA, represents a significant step toward unraveling the mysteries of life beyond Earth. Launched as part of NASA's Mars Exploration Program, the Rover aimed to explore the planet's surface, collect soil samples, and search for biosignatures indicative of ancient microbial life. However, ensuring the scientific integrity of these findings requires stringent planetary protection measures to prevent terrestrial microorganisms from contaminating Mars' pristine environment.

The 1967 Outer Space Treaty codifies planetary protection as a central principle of space exploration, mandating that spacecraft sent to celestial bodies be as sterile as possible. Despite rigorous sterilization protocols, microorganisms from Earth can persist on spacecraft surfaces due to their remarkable ability to survive extreme conditions. These microbes, known as extremotolerant organisms, exhibit adaptations such as spore formation, DNA repair mechanisms, and metabolic flexibility that enable them to thrive in environments mimicking Mars' desiccation, radiation, and low-nutrient challenges.

Understanding the microbial diversity and genomic adaptations of contaminants found on spacecraft is not only essential for refining sterilization techniques but also provides valuable insights into the boundaries of life on Earth. This study focuses on microbial samples collected from the Mars 2020 Rover during pre-launch assembly. By sequencing their genomes using Illumina technology, we identify key taxonomic groups and investigate genetic features associated with survival in extreme environments. These findings contribute to advancing planetary protection protocols while shedding light on the resilience of terrestrial life in space conditions.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Dopant Pyroelectric Coefficient Enhancements in Semi-crystalline Polyvinylidene Difluoride (PDVF) Thin Films and Its Importance for Sensor Science Applications and Technologies.** Matthew Edwards, Alabama A&M University; Andrew Walter, Brookhaven National Laboratory Alabama A&M University.

While most materials do not manifest a pyroelectric coefficient, the beta-phase of the pristine, ferroelectric, semi-crystalline polymer polyvinylidene difluoride (PVDF) does albeit less than

bulk crystals like calcium titanate. The pristine value of PVDF is on the order of 7.41 nC/cm2 0C at 65 degrees Celsius. Additionally, we have observed that doped PVDF thin films manifest an increase in the pyroelectric coefficient, on the order of 200 times larger with silver nano-particle dopants. To that extent, discretionary beamline time, full-field X-Ray imaging of a lithium zirconate crystallite doped PVDF sample was made at FXI beamline of National Synchrotron Light Source II (NSLS-II) in Brookhaven National Laboratory, in Upton, New York, during summer 2024. The results revealed clustering and nonuniformity of the dispersed dopants. We have conjectured that dopant assistance polymer chains conformational alignment has occurred to manifest this outcome in the PVDF thin film matrix due to the interactions of the perovskite crystallites, silver nanoparticles and/or multi-walls carbon nanotubes. We present the outcome of these preliminary results and our plans for furthering the research alliance between Alabama A&M University, Department of Physics, Chemistry and Mathematics and the NSLS-II at Brookhaven National Laboratory.

I. BIOLOGICAL SCIENCES

A Paper Presentation

**Evaluating Bystander Ability to Identify and Manage Out-of-Hospital Cardiac Arrest.** Suhas Patil, University of South Alabama; Matt Howard, South Alabama; Will Montalban, South Alabama; Jason Brooks, South Alabama; Nancy Rice, South Alabama .

Annually in the United States, more than 360,000 people experience sudden out-of-hospital cardiac arrest (OHCA) of whom nearly 95% do not survive to discharge. However, OHCA survival outcome is observed to improve by nearly 3 fold when CPR resuscitation is attempted from bystanders. While the American Heart Association, “Chain of Survival,” highlights the importance of early 911 activation, early CPR, and rapid defibrillation, the importance of a bystander ability to properly identify OHCA remains unclear. This body of work employs a retrospective analysis of 53 million EMS activations characterized in the National Emergency Medical Services Information System dataset to comprehensively evaluate bystander ability to identify and manage OHCA. Of these 53 million EMS activations, 289,165 patients met the inclusion criteria, and were grouped based on reason for dispatch, of which 163,881 were dispatched as cardiac arrest and 125,284 were dispatched for reasons other than cardiac arrest. Then, the type of care provided prior to EMS arrival was evaluated for both groups. A significant relationship between dispatch reason and the type of care received prior to EMS arrival was determined using a chi-square test. To further elucidate this association between proper identification and effective management, a logistic regression model was employed to determine the likelihood of proper management, (i.e if resuscitation was initiated prior to EMS arrival) as a function of proper identification. Results showed that proper identification of cardiac arrest doubled odds of resuscitation being attempted. Another logistic regression model was used to determine demographic influence on proper identification as a function of dispatch reason, which revealed that proper identification is significantly associated with patient gender and incidence location.

I. BIOLOGICAL SCIENCES

A Poster Presentation

**FOXI3 and the Tumor Microenvironment: A Unique Gene Profile in Bone Metastatic Prostate Cancer.**

Ja'Dazia Posey, Troy University; Yubing Chen, ; Samantha Ruwuya, ; Mario Robledo, ; Jacqueline Jones,.

Prostate cancer (PCa) is a prevalent malignancy in men, often metastasizing to bone, which impacts survival rates. Recent studies have highlighted the potential role of FOXI3, a gene expressed during bone development, in advancing PCa progression. Bone marrow, the primary site for PCa metastasis, harbors a complex microenvironment of bone and immune cells, ECM, growth factors, and signaling molecules. Soluble growth factors such as TGF-beta, FGFs, and IGFs, secreted by both cancer and immune cells, regulate tumorigenicity and localized immune responses. However, the complex interplay between FOXI3, resident bone cells, and soluble growth factors in prostate cancer (PCa) metastasis remains unclear. We propose that FOXI3 modulates the expression of genes that enhance metastatic potential in the bone. To investigate this, we analyzed 96 genes associated with tumor metastasis and inflammation. Using FOXI3-ablated human PCa cells (FOXI3-/-), we identified a gene signature characterized by decreased expression of CXCR4, TNFSF10, TWIST1, FN1, MET, and MMP7, alongside increased expression of DCC, MMP2, MMP9, TIMP4, KISS1, EPHB2, and CXCL12. A wound healing assay revealed reduced migration in FOXI3-/- cells, supporting its role in promoting motility. Furthermore, immunohistochemistry of human PCa tissue samples (n=240) demonstrated the clinical relevance of FOXI3. Expression levels increased with tumor grade and stage, particularly in high-grade (3-4) cases, where FOXI3 exhibited greater nuclear localization. Collectively, our findings suggest that FOXI3 drives an aggressive, metastatic phenotype in PCa. Targeting FOXI3 may provide deeper insight into the molecular mechanisms of metastasis and offer potential therapeutic strategies.

II. CHEMISTRY

A Paper Presentation

**Stimulated Raman Photothermal Imaging with Femtosecond Pulses.** Clyde Varner II, Alabama A&M University Alabama A&M University.

A novel photothermal imaging technique, Stimulated Raman Induced Photothermal Microscopy Imaging (SRIPI) was developed with femtosecond pulses. This technique is unique in that it is the result of the combination of coherent Raman scattering (CRS), with the Photothermal effect. When a Coherent Raman process is used to excite vibrational mode in the sample, the excess energy diffuses through the sample as heat. This heat diffusion throughout the sample creates a thermal lens. To detect the thermal lens, because of the Stimulated Raman process, a visible probe laser is passed through the sample. This probe beam is deflected by the lens and measured in the far field using the scattered field by Lock-in detection. The information obtained reports on the same information obtained by Coherent Raman process. The advantage to this method is the removal of the nonresonant background. An important application for biological samples.

II. CHEMISTRY

A Poster Presentation

**XPS Determination of Defect and Vacancy Concentration in Perovskite doped PVDF:PVA Composite Film.** Clyde Varner II, Alabama A&M University; Padmaja Guggilla, Alabama A&M University; Matthew Edwards, Alabama A&M University .

This study will use high-resolution XPS to characterize PVDF:PVA composite films containing $CaTiO_3$ and $LiNbO_3$ nanocrystals. These films, with diameters ranging from 100-150 mm and thicknesses of ~100 µm, exhibit segregated heterogeneous domains where PVA does not fully dissolve and crystalline regions of PVDF and $CaTiO_3$. We will be looking O1s spectra (~529-532 eV) to assess the passivation effects analyze oxygen vacancies and absorbed oxygen and resolve Ti 2p3/2 and Ti 2p1/2 (~458-doublet around 464 eV) and Nb 3d5/2-3d3/2 (~206-209 eV) spectra and several overlapping peaks to Nb 4s (~60eV) and Li 1s (~44 eV) to ensure to ensure the stoichiometry of the nanocrystals. We will deconvolute spectra, use gaussian fitting techniques due to severe overlap, and use the Xpert software to process, fit, and interpret XPS spectra. With the additional UV capabilities, measuring the Valence band maximum and antibonding states may be possible. which contains the Ti 3dt2g and 3de2g (0-7 eV).

II. CHEMISTRY

A Poster Presentation

**Visible Pump Terahertz Probe Measurements of Embedded Polymer Conductivity in Organic Matrices.**
Clyde Varner II, Alabama A&M University; Edwin Heilweil, NIST Alabama A&M University.

We report measurements of the ultrafast photoinduced charge separation and recombination processes of the conjugated donor-acceptor (D-A) polymer PSBTBT and blended in various polymer matrices. Using time-resolved terahertz spectroscopy (TRTS), the time-dependent photoconductivity is measured for samples with PSBTBT weight fractions (WPSBTBT:WPE/PEG/PS) of 2.0% dispersed in high density polyethylene (HDPE), polyethylene-glycol (PEG) and polystyrene (PS). Charge carrier generation is an intrinsic feature of conductive polymers that occurs on subpicosecond and longer timescales and is attributed to initially generated dissociation of bound polaron pairs into free carriers that reside on polymer chains or by adjacent interchain charge transfer and migration. Both interchain and interfacial charge transfer contribute to the measured photoconductivity from the samples and is found to increase as a function of increasing local polarity and hydrogen-bonded environment. The pure PSBTBT polymer film and when dispersed in PS, and HDPE, has a shorter photoconductive free carrier, long-time signal decay than in the hydrogen-bonded, semi-crystalline PEG environment.

II. CHEMISTRY

A Poster Presentation

**Development of Latent Fingermarks on Synthetic Papers and Medical Sponges Using Ninhydrin and 1,8-Diazafluoren-9-one and their Comparison.** Jules Guei, Alabama A&M University; Jules Guei, Alabama A&M University.

Fingermark development has been introduced to criminal investigations as a human identification technique to exonerate or convict suspects since 1892. Since then, numerous techniques (i.e., physical and chemical) have continued to be developed for the detection and analysis of latent fingermarks found at crime scenes. The introduction of ninhydrin in 1955 and later its analog, 1,8-Diazafluoren-9-one (DFO), in 1990 as amino acids sensitive chemical techniques for the detection and visualization of fingermarks, revolutionized ways of forensic fingermark examination on porous surfaces. Although ninhydrin and DFO have become two widely used chemical techniques for the development of latent prints on porous surfaces, little effort has been devoted to the development of new substrates (i.e., semi-porous and non-porous) to expand their application. Moreover, some solvents used in the formulation of DFO are toxic to the environment. In fact, 1,1,2-trichlorotrifluoroethane (CFC113) and HFE-7100, the common solvents in the formulation of DFO, are harmful to the ozone.

This work presents 1) a new formulation of DFO in a solvent system that is friendlier to the environment and 2) the development of fingermarks on semi-porous and non-porous surfaces using ninhydrin and DFO.

REVLAR synthetic papers (non-porous) and McKesson non-woven sponges (semi-porous and non-porous) were evaluated as new substrates for ninhydrin and DFO. Preliminary results showed that synthetic papers and medical sponges could be substrates for ninhydrin and DFO. In fact, the developed fingermarks with ninhydrin on synthetic papers made of polyester or polyolefin (non-porous surfaces) showed pronounced visible friction ridges. The ridges were also visible on McKesson sponges made of polyester/rayon (semi-porous) and nylon/polyester (non-porous) although less intense. DFO reacted with fingermarks on McKesson sponges, but the friction ridges patterns showed less visibility.

The new formulation of DFO in methanol, glacial acetic acid, and a minimum amount of methylene chloride, an environmentally friendlier solvent system than those commonly used, resulted in visible latent prints.

In all, both ninhydrin and DFO reacted well with fingermarks on McKesson non-woven sponges, but ninhydrin produced intense visible prints with REVLAR synthetic paper.

Keywords: ninhydrin, DFO, semi-porous, non-porous, synthetic papers, non-woven sponges

II. CHEMISTRY

A Poster Presentation

**Exploration of transition metal complexes for use in photoinduced electron transfer (PET) pathways.**
Hunter Ballard, Jacksonville State University; Victoria Bamigboye, Jacksonville State University; Anusree Mukherjee, Jacksonvilee State University .

Within the modern scientific and industrial framework, there exists a current and ongoing demand for clean, safe, accessible, efficient, affordable, scalable, and sustainable energy that does not rely on fossil fuels and other carbon-based energy. Although some clean energy sources do exist and are utilized, such as solar, wind, or hydropower, they each fall short because of their intermittent nature. As a result, there are continuing investigations into photocatalytic hydrogen production via photoinduced electron transfer (PET) pathways as a potential solution. The first step required to make this process viable includes finding a sufficient catalytic system. Water-soluble transition metal complexes were the target of this research due to the abundance, low cost, and benign nature of each compound, and they were primarily investigated by first attempting to synthesize a molecule that fit these constraints. They were coupled with a photosensitizer so that electron transfer kinetics could be studied which is a fundamental step for hydrogen production. In this poster, our initial attempt toward this effort will be explained.

II. CHEMISTRY

A Poster Presentation

**Synthesis and Characterization of Cobaloxime Variants for Fluorescence Quenching Applications.**
Victoria Bamigboye, Jacksonville State University; Anusree Mukherjee, .

In this work, two cobaloxime variants, cobalt dimethylglyoxime ($Co(DMG)_2Cl_2$) and cobalt cyclohexylglyoxime ($Co(CHG)_2Cl_2$), were synthesized and characterized. The primary objective of the research study was to produce cobaloximes suitable for use in photoinduced electron transfer pathways, specifically for fluorescence quenching applications. The synthesized cobaloximes were characterized using UV-VIS spectroscopy and solubility tests in deionized water, acetonitrile, and acetone. The UV-VIS spectra confirmed the successful synthesis of both cobaloxime variants, while solubility tests provided insights into their solvent compatibility. The synthesis and characterization of these complexes, along with their role as quenchers, will be discussed in this poster.

II. CHEMISTRY

A Poster Presentation

**Fluorescing Tetrapyridine Hydrogels: From Weak to Peak Basicity.** Hannah Lawley, University of South Alabama .

Tetrapyridine hydrogels are dynamic materials that respond to environmental changes such as heavy metal exposure, temperature variations, and pH fluctuations. These hydrogels exhibit fluorescent shifts upon external stimulation, making them valuable for sensing and detection applications. Our goal is to tailor pH responsiveness, since this aspect of the hydrogels is currently limited. In order to do this, we introduce structural modifications by adding a nitrogen atom and replacing the six-membered ring with a five-membered ring for two of the four pyridines (the external two). It is proposed these changes will increase the hydrogel's basicity, improving its sensitivity to pH variations and expanding its potential applications.

This research is conducted through CURE (Course-based Undergraduate Research Experience), offering students hands-on laboratory experience within a classroom setting. By engaging in real-world scientific research, students develop critical problem-solving skills and gain a deeper understanding of experimental techniques. This innovative approach bridges the gap between theoretical knowledge and practical application, preparing students for future research opportunities.

II. CHEMISTRY

A Paper Presentation

**3D printing of Polymer-Nanocrystal composites.** Clyde Varner II, Alabama A&M University Alabama A&M University.

Polymer-nanocrystal composites are emerging as versatile materials with the potential to bridge the gap between advanced functionality and scalable manufacturing. By combining the structural flexibility of polymers with the catalytic and electronic properties of nanocrystals, these composites enable precise design and optimization for energy-related applications. This work focuses on leveraging 3D printing techniques to fabricate polymer-nanocrystal architectures tailored for use as cathodes in oxygen evolution (OER) and oxygen reduction reactions (ORR).

II. CHEMISTRY

A Poster Presentation

**From Wells to Cells: Advancing Selective PP5 Inhibitors.** Mary Helene Marmande, University of South Alabama; Bailey Baxter, ; Caleb Lopansri, ; Lucy Orr, ; Richard Honkanen, ; David Forbes,.

Both cell culture and animal models of tumor development indicate that Protein Phosphatase 5 (PP5) plays a role in the progression of breast cancer cells. PP5 expression is responsive to both estrogen and HIF1 (hypoxia inducible transcription factor 1), and PP5 acts to inhibit stress induced signaling cascades that trigger apoptosis. Cantharidin, a naturally occurring toxin from the blister beetle, and norcantharidin, a derivative of cantharidin, are catalytic development inhibitors of PP5, but they also inhibit PP1 and PP2A, which makes them toxic to eukaryotic cells. Our long-term goals are two-fold. First this project focuses on the synthesis of norcantharidin derivatives that will selectively inhibit PP5 over PP1 and PP2a with even greater potency. The stereospecific ring-opening of the anhydride functionality of norcantharidin has made advancements toward the goal of synthesizing a more potent and selective inhibitor. Exploiting the de-symmetrization using Cinchona alkaloids via an enantiotopic-group differentiation has revealed significant insight into the docking of enantiomers in the active site of PP5, offering an opportunity to tune next generation derivatives for future investigations into PP5 selectivity and potency. Second, concurrent with the search for a more potent and selective inhibitor, this project explores the use of norcantharidin as the scaffold for a prodrug that will be taken up more readily by cancer cells by applying the aforementioned ring-opening of norcantharidin's anhydride functionality.

II. CHEMISTRY

A Poster Presentation

**Synthesis of effective chain extender for waste polyethylene terephthalate (PET) and its effect on intrinsic viscosity (IV) recovery..** Joseph Eggemeyer, Troy University; Mojtaba Enayati, Troy University.

Polyethylene terephthalate (PET), one of the most common single-use plastics used worldwide, is known for its resistance to environmental degradation. Therefore, its recycling is extremely important to extend the lifecycle of the plastic itself, while also preventing adverse environmental impacts. However, mechanical recycling is showed to have negative effect on the molecular weight and intrinsic viscosity (IV) of the PET because the thermal degradation and chain scission that occur at high temperature and high shear processing and extruding steps. To combat these deteriorating effects, chain extenders (CE) are extruded with the PET to increase the molecular weight and recover its IV. In this work we used the IV and molar weight of our tested plastic to determine how detrimental mechanical recycling processes are, such as basic washing and extruding, to PET's stability. Comparing PET samples that had been washed with 2.0% NaOH and samples that have been extruded at 265°C to unprocessed store-bought PET revealed a 23% and 16% decrease in IV respectively. Our study also conducted tests comparing the effectiveness of an industrially used CE, Joncryl ADR-4468, and our lab synthesized CE. Our CE is synthesized similarly to that of Joncryl ADR-4468, using toluene as the solvent and styrene, glycidyl methacrylate, and butyl acrylate as monomers in a mole ratio of 46:46:8. Our study shows that the Joncryl ADR-4468, can recover 97.4% of the original PET's IV, while the lab synthesized CE is actually able to recover 107.7% of the original PET's IV. Thus, our synthesized CE can be used in lower quantities.

II. CHEMISTRY

A Poster Presentation

**Mirror Mirror On the Wall Who is The Most Active of Them All.** Caleb Lopansri, University of South Alabama; David Forbes, Unversity of South Alabama; Mary Helene Marmande, University of South Alabama; Bailey Baxter, University of South Alabama.

Protein Phosphatase 5 (PP5) is a serine/threonine phosphatase that regulates cell signaling pathways, suppressing growth or inducing apoptosis in response to genetic stress. Overexpression of PP5 has been linked to the progression of certain cancers, including human breast cancer and mouse leukemia, highlighting its potential as a therapeutic target. Cantharidin, a natural toxin, and its demethylated derivative, norcantharidin, have shown promise as PP5 inhibitors. Structural modifications of norcantharidin have revealed that derivatives substituted at position five exhibit stereospecificity, impacting inhibitory potency. Stereospecific derivatives have been synthesized using Cinchona alkaloids for desymmetrization, demonstrating variable efficacy. Preliminary results indicate that Cinchonidine-derived products show lower inhibition compared to Cinchonine-derived counterparts. These findings suggest that optimizing stereospecificity can improve PP5 selectivity, paving the way for next-generation inhibitors to suppress cancerous cell growth in breast cancer and leukemia.

II. CHEMISTRY

A Poster Presentation

**Controlled synthesis and pH-sensitive complexation of poly(methacrylic acid) polyampholytes.** Pavel Nikishau, University of Alabama at Birmingham; Veronika Kozlovskaya, University of Alabama at Birmingham; Eugenia Kharlampieva, University of Alabama at Birmingham University of Alabama at Birmingham.

Polymethacrylic acid (PMAA) and its derivatives are versatile polymers with a large spectrum of applications. The polar carboxylic group attached to the aliphatic polymeric backbone in PMAA can participate in multiple electrostatic hydrogen bonds and form polyampholyte complexes (PAC). Recently, our group developed a method for synthesizing PMAA-based amino copolymers and used them for the precise construction of PMAA hydrogels. However, the properties of the solution of such copolymers have not been studied yet. Herein, we explored RAFT copolymerization for synthesizing such copolymers and studied the formation of the PAC from PMAA-based copolymers. For that, we synthesized PMAA-based polyampholytes with different content of amino group (PMAA-NH2 from 2 to 6 mol.%) from well-defined precursors (Mw of ∼45 kDa and 80 kDa, Đ < 1.35). The distribution of amino groups in the copolymer was found as a gradient according to 1H NMR and DFT analysis. Only copolymers with an amino group content of 3 mol.% or more tended to form PAC. The kinetics and properties of PAC were studied through turbidimetry (UV/VIS) and DLS techniques. Finally, we proposed the idea of polymer chain conformation in the solution of PMAA-based polyampholytes and the mechanism of PAC formation depending on initial and final pH, contents of amino groups, and presence of salt. This work allows for control of the polymer chain conformation and aggregation of polyampholytes and can be used to develop advanced (bio)materials through layer-by-layer film assembly or PAC preparation.

II. CHEMISTRY

A Poster Presentation

**Multilayer hydrogel microcubes: Effects of templating particle morphology on cubic hydrogel properties.** Daniel Inman, University of Alabama at Birmingham; Veronika Kozlovskaya, University of Alabama at Birmingham; Pavel Nikishau, University of Alabama at Birmingham; Sarah Nealy, University of Alabama at Birmingham; Jongwha Oh, University of Alabama at Birmingham ; Claudiu Lungu, University of Alabama at Birmingham; Eugenia Kharlampieva, University of Alabama at Birmingham.

Non-spherical stimuli-responsive polymeric particles have shown critical importance in therapeutic delivery. Herein, pH-responsive poly(methacrylic acid) (PMAA) hydrogel micro-cubes are synthesized from PMAA/poly(N- vinylpyrrolidone) hydrogen-bonded multilayers; where PMAA layers are crosslinked within templated porous microparticles. Here, we investigate the effects of template porosity and surface morphology on cubic PMAA multilayer hydrogel properties. We found that the hydrogel structure depends on the template's calcination time and temperature. The pH-triggered PMAA hydrogel cube swelling depends on the hydrogel's internal architecture, where hollow capsule-like or non-hollow continuous hydrogels can be produced. The loading efficiency of the doxorubicin (DOX) drug inside the microcubes analyzed by high-performance liquid chromatography (HPLC)shows the dependence of the drug uptake on the network structure and morphology controlled by the template porosity. Varying the template calcination from low (300 °C) to high (1000 °C) temperature results in a 2.5-fold greater DOX encapsulation by the hydrogel cubes. The effects of hydrogel surface charge on the DOX loading and release are also studied using zeta- potential measurements. This work provides insight into the effect of structural composition, network morphology, and pH-induced swelling of the cubical hydrogels and may advance the development of stimuli-responsive vehicles for targeted anticancer drug delivery.

II. CHEMISTRY

A Poster Presentation

**Effect of linker defects (open sites) of Metal organic frameworks on Chromium (VI) adsorption..**

Oluwasegun Raji, University of Alabama in Huntsville; Jie Ling, University of Alabama, Huntsville; Urvi Mysore, James Clemens High school .

Metal-organic framework (MOF) materials have shown significant potential for environmental remediation, particularly in removing toxic heavy metals from wastewater. Some MOFs are known for their stability and high adsorption capacity due to their large surface area and pore volume. However, using acid modulators on specific MOFS, different particle sizes with varying surface areas and pore volumes are engineered toward adsorption efficiency. In this study, we synthesized different particle sizes of UiO-67 and altered the composition and structure of the MOF by introducing acid modulators to create a linker defect. Results show that the variation in organic linker defects determines the particle size and, invariably, the chromium adsorption capacity. The morphology of the MOF was analyzed using a scanning electron microscope (SEM), and the quantification and analysis of the metal/ligand ratio were performed using thermogravimetric analysis (TGA). This study provides new insight into materials chemistry and environmental science. It offers a potential alternative to wastewater treatment, thereby potentially revolutionizing how we approach future research on toxic waste removal.

II. CHEMISTRY

A Poster Presentation

**Targeted Brain-Selective Nicotinic Receptor Modulation: Investigating Epibatidine Derivatives with Methyl and Butyl Groups for Neural Specificity.** Ashlyn Smith, Jacksonville State University; Sydney Heidrich, Jacksonville State University; Stephen Slauson, Jacksonville State University .

Through the years of medicine, opioids have always been a controversial treatment for neurovascular pains in patients. Studies within opioids and their treatments have mixed results with many becoming addicts to the medicine. Within opioids, opioid agonists bind to the receptor and begin mimicking the action of endorphins. While opioid agonists are focused on opioid receptors to relieve pain, there are other important agonists focused on nicotinic acetylcholine receptors to increase alertness and arousal. An example of this would be Epibatidine, an alkaloid specifically in poison dart frogs. This drug could become a potential alternative in pain relief, only its high toxicity rate and small therapeutic window makes it not the first choice. Although, with the right derivative added, it could become a potential working drug for humans. The idea behind the research is that Epibatidine affects the entire nuerological system but with the correct structure and derivatives, it could only target specific nicotinic receptors to relieve pain. With the process of Dies Alder, TLC, NMR, and column chromatography; results could show, with the breaking of the double bond in the cyclic base and removal of the carbamate, Epibatidine could have less toxicity by minimizing unwanted side effects.

II. CHEMISTRY

A Paper Presentation

**Assembly of Potent and Selective Inhibitors of PP5.** Bailey Baxter, University of South Alabama .

Protein phosphatase 5 (PP5) is a serine/threonine phosphatase implicated in various cellular processes, including stress response, cell growth, and apoptosis. The dysregulation of PP5 has been associated with cancer progression, making it a potential therapeutic target. Norcantharidin, a derivative of cantharidin, is a known inhibitor of PP5; however, its undesirable cytotoxicity limits its clinical application. To enhance its therapeutic potential, we synthesized a series of norcantharidin derivative prodrugs aimed at increasing selectivity for PP5 inhibition in cancer cells.

Our synthesis approach involved an anhydride ring opening reaction of norcantharidin with various alcohols to form ester derivatives. This reaction proceeds via nucleophilic attack of the alcohol on the anhydride ring, yielding the corresponding norcantharidin ester. By modifying the alcohol moiety, we were able to introduce functional groups that could enhance selectivity and reduce off-target effects. Additionally, cinchonidine and cinchonine, chiral alkaloids, were used to create stereoisomerically enriched norcantharidin derivatives. The resulting prodrugs exhibited promising stereospecific interactions with PP5, potentially leading to improved therapeutic results.

II. CHEMISTRY

A Paper Presentation

**Diversifying Derivatives: Exploring New Functionalities of Lipid-like Nanoparticles.** Mary Helene Marmande, University of South Alabama; Bailey Baxter, University of South Alabama; David Forbes, University of South Alabama .

Lipid-like Nanoparticles (LLNPs) represent a cutting-edge drug delivery system, effectively encapsulating mRNA to protect it from degradation by physiological barriers. Despite their success, current LLNPs are synthetically prepared through complex, multi-step processes. This study aimed to streamline LLNP assembly by reducing the number of synthetic steps required to create the core scaffold and expanding the diversity of carboxylic acid derivatives to include carbamate, urea, and amide functionalities.

During an attempted Curtius rearrangement, an unexpected product was obtained, highlighting challenges in reaction specificity. However, using a less reactive substrate, the desired carbamate was successfully synthesized, demonstrating that the number of synthetic steps in LLNP assembly can be reduced by half. Therefore, the Curtius rearrangement proved viable for simplifying LLNP synthesis, paving the way for more efficient and diverse nanoparticle production. This advancement has the potential to enhance the scalability and accessibility of LLNP-based drug delivery systems.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**A Geometrical Measure of Batsmanship in Test Cricket.** Arjun Tan, Alabama A&M University .

Cricket enthusiasts across the globe love to argue about the greatest batsman in Test history. Almost invariably, the main criterion used is the batsman's batting average in Test cricket. However, there are two other equally important statistics in batting, viz., the aggregate runs scored and the total centuries made in Test cricket. Of these, the aggregate runs scored is the product of two quantities whose magnitude is geometrically represented by the area of the rectangle formed by the two. Its magnitude is far greater than the scoring average and is therefore incompatible with the latter for comparison. In this study, this quantity is compressed into a one-dimensional quantity by extracting its square root. The three quantities of batting average, compressed aggregate runs scored and total centuries made now represent three dimensions of batsmanship in Test cricket. Geometrically, the three quantities are represented by the orthogonal components of a vector in three-dimensional space, whose resultant is chosen to serve as the measure of batsmanship in Test cricket. In this scheme, the 10 greatest batsmen of all time are: (1) Tendulkar; (2) Kallis; (3) Ponting; (4) Dravid; (5) Sangakkara; (6) Lara; (7) Chanderpaul; (8) Border; (9) S. Waugh; and (10) Younis Khan.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Unearthing the Tetrahedral Shape of the Earth and Locating its Four Vertices.** Arjun Tan, Alabama A&M University .

The notion of the 'Pear-shape of the Earth' is widely known to the public at large. However, a similar concept called the 'Tetrahedral-shape of the Earth', is not. This concept was recently revived by Mentock, who argued that the tetrahedral Earth was more appropriate than the pear-shaped Earth. In this study, we construct three model orientations of the tetrahedron within a circumscribed spherical Earth to see which orientation best locates the geoid highs with its four vertices. In the first model (Model A), one vertex is situated at the north pole, a second on the Greenwich meridional plane and the two others at azimuthal angles of 120o and 240o respectively. Two other models are generated from Model A to better locate the vertices with the geoid highs. The method consists of converting the spherical coordinates of the vertices to rectangular coordinates; then rotating the coordinates system by a desired angle; and finally, converting the new rectangular coordinates back to the spherical coordinates. The origin of the rectangular coordinate system is at the center of the Earth, with z-axis pointing towards the North Star, the x-axis lying in the Greenwich meridional plane, and y-axis fixed by the right-hand rule. Model B is created by rotating the coordinate system about the y-axis counter-clockwise by –20o; and Model C is created by rotating the coordinate system about the x-axis counter-clockwise by –20o. The locations of the vertices in Models B and C show improved agreements with the geoid highs.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Uniqueness of Squared Rectangles.** Youngsoo Kim, Tuskegee University; Young Kim, Tuskegee University; Byunghoon Lee, Tuskegee University .

We present the uniqueness property of squared rectangles. When a square is dissected into multiple squares, there is a unique solution of the sizes of the squares up to a scaling factor. One of the proofs converts the problem into an electrical network problem and uses Kirchhoff's Laws. We present a way to construct a canonical system of linear equations producing the solutions.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Process Development for Optically Gated Diamond Transistor.** Angela Davis, Alabama A&M University; Caitlin A. Chapin, LLNL; Clint Frye, LLNL; Sara Harrison, LLNL; Bikramjit Chatterjee, LLNL ; Qinghui Shao, LLNL; Lars Voss, LLNL.

Diamond, renowned for its exceptional properties, presents a promising avenue for the development of high-power optoelectronic devices. Its wide bandgap and superior thermal conductivity offer significant advantages over conventional semiconductor materials. However, realizing a diamond-based device necessitates the establishment of specialized fabrication techniques, particularly in the realm of etching. The process of designing and building a diamond high-power optoelectronic device involves the most critical stage of identifying an etching process. Traditional etching methods often prove ineffective, necessitating the development of novel techniques. However, controlling the etching process to achieve precise feature sizes and geometries remains a significant hurdle, particularly for nano-scale devices.

III. PHYSICS AND MATHEMATICS

A Paper Presentation

**Fano Resonance in Ion-Bombarded Au-SiO2 Nanocomposites: Analysis of Mode Coupling and Optical Properties.** Angela Davis, Alabama A&M University; Jonathan Lassiter, Alabama A&M University; Satilmis Budak, Alabama A&M University; Padmaja Guggilla, Alabama A&M University; Clyde Varner, Alabama A&M University .

This study investigates the optical properties of ion-bombarded Au-SiO2 nanocomposites, focusing on the enhanced Fano resonance observed in these samples. The formation of nanocrystals and nanocavities due to ion bombardment leads to significant interactions between plasmonic and vibrational modes, resulting in pronounced Fano resonance in the strong coupling regime. The study aims to explain the closer spacing of modes, the elevated baseline absorbance, and the asymmetric lineshape observed in the ion-bombarded samples. A detailed analysis is provided, comparing these findings with other sample preparations, such as Au-coated SiO2 and 20 nm Au colloidal on SiO2. The implications of these results for understanding plasmonic behavior and their potential applications in nanophotonics are discussed.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Data Analyses of LEGEND Experiment and Model Beyond the Standard for Neutrinoless Double Beta Decays.** Pablo Ruiz Crespo, Alabama A&M University; Ian Guinn, ORNL; Tianxi Zhang, AAMU; Harisree Krishnamoorthy, ORNL.

In the standard model, a neutrinoless double beta decay is a forbidden transition due to the violation of lepton number conservation. The Large Enriched Germanium Experiment for Neutrinoless ββ Decay (LEGEND) is dedicated to detecting this extremely rare mode of nuclear decay. Observations of this rare nuclear transition would demonstrate that the neutrino is a Majorana fermion and its own antiparticle which would have fundamental implications for neutrino physics, theories beyond the standard model, and cosmology. In summer 2024, at Oak Ridge National Laboratory (ORNL), we conducted data analyses of the LEGEND-200 Experiment and investigated the effect of the signal electronic response on the pulse shape discrimination (PSD) parameters. By introducing a ringing component to the electronic response, we assessed the distributions of critical PSD parameters such as current amplitude in the signal waveform. Our findings suggest that incorporating the ringing effect increases the acceptance band for multi-site signal events by 10%. Based on the two flavor multi-excitation quark model beyond the standard, we explored possible mechanisms for neutrinoless double beta decay and analyzed the fine structures of Feynman diagrams that describe this decay without the emission of neutrinos. The work is partially supported by the Education Collaboration and LEGEND programs of DOE and NSF at Oak Ridge National Laboratory and Research Initiation Award (#2400021) of the NSF HBCU-UP program at Alabama A&M university.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Data Analyses of LEGEND Experiment and Model Beyond the Standard for Neutrinoless Double Beta Decays.** Pablo Ruiz Crespo, Alabama A&M University; Ian Guinn, ORNL; Harisree Krishnamoorthy, ORNL; Tianxi Zhang, AAMU.

In the standard model, a neutrinoless double beta decay is a forbidden transition due to the violation of lepton number conservation. The Large Enriched Germanium Experiment for Neutrinoless ββ Decay (LEGEND) is dedicated to detecting this extremely rare mode of nuclear decay. Observations of this rare nuclear transition would demonstrate that the neutrino is a Majorana fermion and its own antiparticle which would have fundamental implications for neutrino physics, theories beyond the standard model, and cosmology. In summer 2024, at Oak Ridge National Laboratory (ORNL), we conducted data analyses of the LEGEND-200 Experiment and investigated the effect of the signal electronic response on the pulse shape discrimination (PSD) parameters. By introducing a ringing component to the electronic response, we assessed the distributions of critical PSD parameters such as current amplitude in the signal waveform. Our findings suggest that incorporating the ringing effect increases the acceptance band for multi-site signal events by 10%. Based on the two flavor multi-excitation quark model beyond the standard, we explored possible mechanisms for neutrinoless double beta decay and analyzed the fine structures of Feynman diagrams that describe this decay without the emission of neutrinos. The work is partially supported by the Education Collaboration and LEGEND programs of DOE and NSF at Oak Ridge National Laboratory and Research Initiation Award (#2400021) of the NSF HBCU-UP program at Alabama A&M university.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Photonic crystals for light sail space propulsion..** Dimitar Dimitrov, Tuskegee University; Elijah Taylor-Harris, Tuskegee University Tuskegee University.

The proposed research aims to design and manufacture photonic crystals with three dielectric constant regions. The materials used are germanium pillars, airholes, and PMMA polymer. The diameters of the holes will be maximized while the diameters of the pillars will be minimized to achieve the optimal area-to-mass ratio. Such a ratio will enable the resulting photonic crystal to be used for light sail space propulsion applications. The main feature of a photonic crystal is a photonic band gap: frequency regions where the light can not propagate and is reflected theoretically 100%. In photonic crystal slabs, the light is polarized while propagating through the periodic material, technically speaking, into Transverse Electric and Transverse Magnetic polarizations. To achieve complete PBG, the traditional structure and lattice of the photonic crystal must be heavily modified. Our extensive FDTD and Plane wave method simulations point to wide complete PBGs in the proposed three-dielectric constant photonic devices. Theoretically, such a combination will break down certain symmetries in K-space, which otherwise closes the PBG between the energy modes. Additionally, the APCS must be thin enough to be two-dimensional like a membrane; otherwise, much of the light will be lost due to the lack of vertical confinement. A light sail cannot consist of just one APCS of about 50 nm height. Therefore, in future research, we will attempt to manufacture layers of APCSs one over another that will function as a photonic light sail.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Quantum Unruh Radiation and Performances of Superconducting Qubits.** De'Angelo Bailey, Alabama A&M University; Tianxi Zhang, Alabama A&M University.

A remarkable prediction of quantum field theory is that an accelerating observer will detect a thermal radiation, called quantum Unruh radiation, with temperature proportional to acceleration. As a particle in a force field accelerates, it detects Unruh radiation. Therefore, a particle with mass in a gravitational field detects Unruh radiation with temperature proportional to the gravitational field. A particle with electric charge in an electric field detects Unruh radiation with temperature proportional to the electric field and charge-mass ratio of the particle. Zhang has recently explored quantum Unruh effect on singularity and radiation of black holes, spectra of atoms, and processes of beta decays. In this study, we investigate how the quantum Unruh radiation affects performances of superconducting qubits, constructed by using Josephson junctions, which are formed by two superconductors that are separated by a thin insulating barrier. Experimentally, it has been discovered that an electric current could flow through Josephson Junction due to quantum tunneling. Voltage developed across the barrier is proportional to the rate of phase change or the frequency of oscillations. For a typical Josephson junction with oscillation frequency of tera-hertz and barrier thickness of micro-meters, the electric field generated in the barrier could be one-tenth of milli-volts per meter, which can be pulsated and enhanced maximumly up to hundreds of times when the two superconductors have different properties and variations. Super-electrons in the barrier will be accelerated by the electric field and detect Unruh radiation with temperature up to tens of milli-Kelvins, which may significantly affect the performance of superconducting qubits. In this poster presentation, we will present new results obtained from our recent studies, supported by NSF Research Initiation and IBM-HBCU Quantum Center Awards.

III. PHYSICS AND MATHEMATICS

A Paper Presentation

**New Insights into Electron-Positron Annihilation and Pair Production.** Tianxi Zhang, Alabama A&M University .

It is well-known that nuclei are made of protons and neutrons, which are composed of up and down quarks. When nuclei decay, particles including protons, alpha particles, beta particles, neutrinos, and gamma rays are emitted. It is direct for nuclei to emit protons or alpha particles, but mystery why emit beta particles, neutrinos, or gamma rays. Recently, Zhang developed a four-element theory, from which all fundamental interactions are classically unified into a single interaction between complex energy, the weak force is found to be an interaction between electric and color charges, and a new two-flavor multi-excitation quark model is developed. This newly developed quark model suggests leptons such as electrons, positrons, and neutrinos can be generated from color or electric charge annihilations of quarks and antiquarks. Photons can be produced when quarks and antiquarks also annihilate their masses. This study explores how electron-positron annihilation and pair production occur based on various levels of quark-antiquark annihilations. It is found that when an electron combines or collides with a positron, both may get disintegrated into pairs of quarks and antiquark. Some of them may even get excited and decay via emitting more quark-antiquark pairs. Annihilations of those quarks and antiquarks generate photons or neutrinos. The two or more gamma ray photons from a single electron-positron annihilation are found to be not identical. In addition, an energetic gamma ray photon when interacts with a nucleus or particle gets disintegrated into a pair of quark and antiquark, which may be excited and emit more quark-antiquark pairs. Annihilations of those quarks and antiquarks can produced leptons including electrons and positrons, neutrinos, and photons. In this presentation, we will show new results obtained from our recent studies, supported by NSF Research Initiation and IBM-HBCU Quantum Center Awards.

III. PHYSICS AND MATHEMATICS

A Paper Presentation

**Development of Dielectric Coatings for Perovskite Doped Organic Solar cells.** Angela Davis, Alabama A&M University; Yu Lei, University of Alabama in Huntsville; Edwin Heilweil, NIST; Padmaja Guggilla, Alabama A&M University.

Organic solar cells (OSCs) have emerged as a promising renewable energy technology due to their lightweight, flexible, and cost-effective characteristics. In this study, we present the development of a hybrid inorganic-organic Si3N4:Li2ZrO3:PVDF Composite film. The incorporation of Si3N4 and perovskite nanocrystals within the PVDF matrix effectively allows for tailored properties to both thermal conductivity and Ionic conductivity due to the two PVDF dopants. Our approach demonstrates enhanced charge carrier dynamics, increased open-circuit voltage, and improved overall power conversion efficiency. This work highlights the potential of combining perovskite and Si3N4 nanocrystals with dielectric coatings to address intrinsic challenges in OSCs, paving the way for more efficient and durable organic solar cell technologies.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Characterizing Cesium Hafnium Chloride through Photoluminescence Analysis.** Nehemiah Ibi-Eletta, Alabama A&M University; IBRAHIM BELLO, Alabama A&M University; Oluseyi Babalola, Alabama A&M University; Elijah Adedeji, Alabama A&M University.

This study explores the photoluminescence properties of cesium hafnium chloride (Cs2HfCl6), a material with promising applications in optoelectronics and scintillation technologies. A fluorescence spectrometer characterized the photoluminescence behavior of (Cs2HfCl6) under various wavelength excitations. The study analyzed the emission spectra, quantum efficiency, and decay lifetimes to understand the material's electronic transitions and defect-induced luminescence.

These findings underscore the significance of Cs2HfCl6 as a luminescent material with potential applications in radiation detection and solid-state lighting. Further investigations, including doping and compositional modifications, are recommended to enhance its optical performance and broaden its applicability.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Quantum Unruh Effect and Radiation of Black Holes.** Hannah Sukarloo, Alabama A&M University; Tianxi Zhang, .

Quantum Unruh Effect and Radiation of Black Holes

Hannah Sukarloo and Tianxi Zhang

Department of Physics, Chemistry, and Mathematics, Alabama A&M University, Normal, AL 35762

Quantum Unruh effect is a remarkable prediction of quantum field theory. It refers to an accelerating observer that detects a thermal radiation with temperature proportional to the acceleration. Since acceleration is indistinguishable from gravitational field in accordance with the Mach principle of equivalence, an observer at rest in a gravitational field detects an Unruh radiation with temperature proportional to the gravitational field. Hawking first studied radiation of black holes with this effect showing that a black hole radiates with power inversely proportional to the square of a black hole mass. Recently, Zhang indicated that Unruh radiation is gravitational, not due to motion of thermal particles, so we cannot apply the Stephan-Boltzmann law to calculate the power of black holes based on the Unruh temperature of the surface. Zhang further showed that the emission power of Unruh radiation from a gravitational object should be calculated in terms of the rate of increase of the total Unruh radiation energy outside the object. In addition, mass falling into a black hole does not form a sizeless singularity, but instead it forms a finite mass-dependent singularity sphere. In this study, we will investigate the quantum Unruh effect on radiation of black holes in further detail. This presentation will contain new results obtained from our recent studies, supported by NSF Research Initiation and IBM-HBCU Quantum Center Awards.

III. PHYSICS AND MATHEMATICS

A Paper Presentation

**Growth and Characterization of Cesium Hafnium Chloride Scintillator Crystal from Melt..** Elijah Adedeji, Alabama A&M University; Angel Reeder, Alabama A&M University; Stephen Babalola, Alabama A&M University Alabama A&M University.

We report an effort to grow Cesium Hafnium Chloride (CHC) scintillator crystals from the melt using the Bridgman and modified Czochralski (CZ) methods. CHC, initially discovered as a luminescent material, has been re-invented as a promising scintillator for gamma-ray detection. The material exhibits a cubic crystal structure, is nearly non-hygroscopic, and offers highly proportional scintillation with performance superior to thallium-activated sodium iodide (NaI:Tl) and comparable to lanthanum bromide. Unlike many other scintillator crystals, CHC achieves a high light yield and exceptional energy resolution without requiring doping.

The modified CZ method employed in this study features an ampoule equipped with a rotatable borosilicate stir rod to facilitate the controlled descent and precise introduction of the seed crystal into the melt. The ampoule's O-ring ensures a controlled atmosphere, safeguarding the hygroscopic starting materials and stabilizing the melt. Additionally, the setup generates hafnium vapor within the ampoule, contributing to crystal quality.

Grown crystals and a seed crystal were subjected to comprehensive characterization for a comparative study of their structural and scintillation properties. These findings demonstrate the significant potential of CHC as a next-generation scintillator material.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**First-Principles Electronic Calculations of Monolayer 2D TMD Materials: MoS2, MoSe2, WSe2, WS2.**

Elijah Adedeji, Alabama A&M University; Jingsong Huang, Centre for Nanophase Material Science (CNMS); Eva Zarkadoula, Centre for Nanophase Material Science (CNMS); Ryan Morelock, Centre for Nanophase Material Science (CNMS); Ganesh Panchapakesan, Centre for Nanophase Material Science (CNMS) Alabama A&M University.

Over the past few decades, monolayers of transition metal dichalcogenides (TMDs), a notable class of two-dimensional (2D) materials, have gained significant attention due to their intriguing physics and the urgent need for their potential applications in nanoelectronics and photonics.

This study delves into the first-principles electronic calculations of monolayered TMD materials, specifically MoS2, MoSe2, WSe2, and WS2. Employing Density Functional Theory (DFT) within the framework of the Vienna Ab initio Simulation Package (VASP), we explore the electronic band structures, density of states (DOS), and related vibrational properties of these materials

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Analysis of Hurricane Formation using DMD.** Goodluck Badewole, Alabama A&M University .

Hurricanes are highly destructive phenomena that arise from complex atmospheric and oceanic interactions. Examples include Hurricane Katrina and Hurricane Harvey, which caused significant devastation. In this project, we analyzed snapshots associated with hurricane Katrina, focusing on outgoing longwave radiation (OLR) and vorticity. Using the Dynamic Mode Decomposition (DMD) technique, we aimed to reconstruct hurricane formation dynamics with a reduced number of dominant modes while retaining essential spatiotemporal features. The dataset consisted of 672 video frames, which were converted into column vectors to form high-dimensional matrices. Singular Value Decomposition (SVD) was applied to identify dominant modes, retaining 99% of system energy. Modes were selected based on half-life times, amplitudes, and energy contributions, and reconstruction accuracy was evaluated against the original data. Key findings revealed dominant spatiotemporal patterns tied to hurricane formation. High-energy modes captured oscillatory behaviors and exponential growth rates linked to atmospheric conditions conducive to hurricane genesis. Reconstructions using top modes achieved high fidelity, with relative errors below 5%. While DMD effectively highlighted critical dynamics, further refinements are needed to enhance accuracy and broaden applicability. Future research will focus on incorporating additional meteorological variables and expanding datasets to identify long-term trends, improving predictive capabilities for hurricane formation and evolution.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Period Change Study of CC And.** Charlie Hendrix, University of North Alabama; Mel Blake, .

The current research study examines the pulsating variable star CC And. This star has been known to be a pulsating star since the 1960's but thus far no study of its period change has been conducted. Other authors have suggested that it is a suspected binary system. The light travel time effect could help determine if this is true. We have combined our own data from 2021 to 2024, as well as data from online sources such as the AAVSO to determine the O-C diagram. Our results suggest that there may be some light travel time effects, however, due to a gap in the data it is difficult to determine the results.

III. PHYSICS AND MATHEMATICS

A Paper Presentation

**Constructing a Micro Raman Spectrometer to Identify Gemstone Inclusions.** Jackson Cornelison, University of North Alabama; Brian Thompson, .

Gemstone inclusions consist of microscopic materials trapped inside the gems as they form. These inclusions may be comprised of solid mineral crystals or fluids or gas bubbles. Identification of these inclusions can aid in identifying origins of gemstones. Inclusion identification originated with gemstone microphotography, which is still an active pursuit. However, photographs are not enough to conclusively identify inclusion composition. Recent advances in laser-excited micro Raman spectroscopy now offers a way to ascertain the material that makes up an inclusion. However, commercial versions of this technology are expensive. So, we are building a micro Raman spectrometer from scratch. Here, we present a progress report on this build.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Progress Towards Studying asteroids, Impacts and Occultations at UNA Observatory.** Seth Kemble, University of North Alabama; Mel Blake, .

We have begun a program at UNA Observatory to study objects in the solar system. Observations of asteroid occultations, where asteroids pass in front of stars can provide information about their shapes and orbits. Likewise, observations of their brightness changes can be used to determine their spin period and shape. The lunar surface is constantly struck by meteoroids of various sizes, and monitoring for such impacts can help gain information about meteoroid swarm densities and gives information about the lunar environment. As a first step we have been installing and testing equipment to study asteroids, lunar impacts and asteroid occupations. We present the results of our progress and describe the next steps needed to conduct such studies.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Period Change Study of CC And.** Charlie Hendrix, University of North Alabama; Mel Blake, .

The current research study examines the pulsating variable star CC And. This star has been known to be a pulsating star since the 1960's but thus far no study of its period change has been conducted. Other authors have suggested that it is a suspected binary system. The light travel time effect could help determine if this is true. We have combined our own data from 2021 to 2024, as well as data from online sources such as the AAVSO to determine the O-C diagram. Our results suggest that there may be some light travel time effects, however, due to a gap in the data it is difficult to determine the results.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Photoluminescence Spectroscopy Study of Cesium Hafnium Chloride (CHC) Crystal.** Ibrahim Bello, Alabama A&M University; Natarcia Chisholm, Alabama A&M University; Elijah Adedeji, Alabama A&M University; Nehemiah Ibi-Eletta, Alabama A&M University; Stephen Babalola, Alabama A&M University ; Marius Schamschula, Alabama A&M University .

We report a photoluminescence study on Cesium Hafnium Chloride (CHC) grown using a modified Czochralski method via a Cary Eclipse

Fluorescence Spectrophotometer with an excitation wavelength of 250nm. The modified Czochralski is a technique in which the crystal is melted and

maintained at a temperature slightly above the melting point (820OC), and a pulling rod containing the seed crystal is lowered to touch the melt. The

crystal is pulled slowly while the seed crystal is rotated to keep the crystal uniform and cylindrical. The investigation focuses on the first-grown CHC

crystal and its seed crystal. Through a comparative systematic analysis, the photoluminescence properties of these crystals are explored, shedding light on their optical characteristics and potential applications.

The study explores the crystals' emission characteristics and spectral features under the specified excitation conditions. This research also aims to use our findings to determine the crystal's purity through a comprehensive analysis of the photoluminescence spectra.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Study of Luminescence and Transmission Properties of Er3+ ions in doped Boric – Lead Glass..** Dimitar Dimitrov, Tuskegee University; Joshua Hall, Tuskegee University; Akshaya Kumar, Tuskegee University Tuskegee University.

Rare earth dope glass has been widely used in optoelectronics and Photonics. The present study was performed with different concentrations of Er atoms doped in lead–boric glasses. Different temperature regimes were used to obtain both the crystal and glass phases of the samples. Ultraviolet, Visual Spectrum, and near-infrared absorption and transmission measurements were performed to find the energy levels of the Er3+ ions. Additionally, a fluorescent study using a 532 nm diode laser as an excitation source has been performed.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Measurements of the Higgs Boson.** Ruvarashe Nyabando, Alabama A&M University .

The Compact Muon Solenoid (CMS), based at the Large Hadron Collider (LHC), explores the production of boosted Higgs bosons, among other interesting physics. The recently discovered Higgs Boson is thought to be the key to undiscovered physics and understanding the Higgs mechanism, which explains how particles have mass. The most common decay mode for the Higgs Boson is the decay to a bottom-antibottom quark pair. However, other decay processes produce the same decay products. The background signals pose a challenge for precise Higgs measurements.

This research project uses Monte Carlo simulation data to study boosted jets created by Higgs decays in the Higgs to bottom-antibottom quark pair. The soft drop algorithm is a grooming algorithm used at the LHC to remove soft and wide-angle radiation. This study investigates the parameters of the soft drop algorithm to achieve more precise reconstructed Higgs mass measurements for collected events by observing changes in plots of transverse momentum, soft drop mass, and N2. We varied the soft threshold and the angular exponent to accurately recollect events.

Our findings indicate that a higher angular exponent resulted in less grooming of the original jet structure. However, more wide-angle radiation is maintained. Higher values of the soft threshold resulted in more constituents and wide-angle radiation being removed due to more grooming. To investigate the effects of varying soft drop parameters further, different substructure variables would need to be analyzed for a more comprehensive analysis. This study contributes to the ongoing research of the Higgs Boson, improving our understanding of cutting-edge physics.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Particle-in-cell Simulation of Relativistic Jets.** Tatenda Joseph, Alabama A&M University .

Plasma Physics encompasses the study of plasma and its fundamental governing principles, which hold relevance across various domains, including astrophysics. Relativistic jets, observed as streams of plasma emanating from black holes, propelled at velocities nearing the speed of light, represent an intriguing phenomenon in the cosmos.

In this study, I employ Particle-In-Cell Code, a computational methodology well-suited for modeling relativistic jets, to investigate their propagation dynamics from black holes. Leveraging Fortran for code development, simulations were executed on the Frontera platform, with subsequent visualization and analysis facilitated through VisIt.

My findings provide insights into the intricate physics governing the behavior of relativistic jets, shedding light on their origin, propagation mechanisms, and interaction with surrounding environments. Through meticulous analysis of simulation results, I uncovered nuances crucial for advancing our understanding of relativistic jets and related phenomena.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Effect of metallic silver particles on the luminescence spectrum of Sm3+ -doped oxide glass.** KEVIN BENNETT, Alabama A&M University; kevin bennett, ALABAMA A & M UNIVERSITY; RAMI BOMMAREDDI, ALABAMA A & M UNIVERSITY; VISWA MANDADAPU, ALABAMA A & M UNIVERSITY.

Glasses embedded with Sm3+ and silver were made by the melt quenching technique. Metallic particles were induced in the glasses by the heat-treatment technique. A detailed spectroscopic investigation of Sm3+ and/or Ag doped mixed oxide glasses was conducted to understand the effect of metallic silver particles on the luminescence spectrum of Sm3+ -doped glass. Appropriate amounts of Sodium carbonate, Yttrium carbonate, tellurium oxide, boron oxide, samarium oxide and silver oxide were measured and thoroughly mixed for an hour. The resulting mixture was poured into an alumina crucible and melted at 1200°C for an hour in ambient air, by using a tube furnace. At elevated temperatures carbonates decompose to oxides. The resulting melt was poured into an aluminum mold and cooled to room temperature, naturally. The resulting glass was polished using different grades of polishing paper and polishing powders. Absorption spectra, emission spectra and lifetime measurements were performed to characterize the samples. The addition of silver compound modified the absorption spectrum of the Sm3+ -doped sample in the violet region. When a co-doped glass was heat treated at 520°C for 16 hours, Sm3+ emission intensity increased more than 100%. Optical microscope images revealed microstructure in addition to silver nanoparticles. When the sample was heat treated again at 520°C for another sixteen hours the Sm3+ emission intensity increased five times to that observed before heat treatment. After each heat treatment the particle size changes which was indicated by microscope images. For an Ag doped sample, emission spectral features observed with a violet diode laser excitation are different from those observed with an excimer laser excitation. This clearly indicates a range of particle sizes for Ag in the glass sample which was confirmed by the spectroscopy measurements, microscope images and lifetime measurements.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Process Parameter Optimization of Recycled SS316L Powder Based Additive Manufacturing Process for Enhancing Fatigue Strength Using Machine Learning.** Ajibike Farounbi, Alabama A&M University; Padmaja Guggilla, Alabama A&M University; Judith Schneider, University of Alabama Huntsville .

Additive manufacturing (AM) has emerged as a transformative technology, offering unprecedented design flexibility and material efficiency. However, the reuse of metal powders, such as recycled SS316L stainless steel, in AM processes presents significant challenges to mechanical properties, particularly fatigue strength, which is critical for structural applications. This study investigates the optimization of process parameters in a recycled SS316L laser bed powder fusion process to enhance fatigue strength, utilizing advanced machine learning (ML) techniques. A comprehensive experimental framework was established to assess the influence of key process parameters, including laser power, scanning speed, layer thickness, and hatch spacing, on the resulting microstructure and fatigue performance of printed components. Data collected from previous experiments in literature were used to train machine learning models and Random Forest (RF) regression to identify optimal parameter combinations and categorize performance trends. The study's findings demonstrate the effectiveness of integrating machine learning for process parameter optimization, achieving a notable improvement in fatigue strength while maintaining high material utilization rates. The integration of machine learning techniques in AM process optimization sets a precedent for future research, fostering innovation in sustainable and high-performance additive manufacturing technologies.

III. PHYSICS AND MATHEMATICS

A Poster Presentation

**Response surface methodology for optimization of poly acrylonitrile (PAN) nanoparticles..** karishma Gupta, Alabama A&M University; Oluseyi Babalola, Alabama A&M University; Padmaja Guggilla, Alabama A&M University .

Nowadays, the toxicity of polyacrylonitrile is attracting extensive attention in the field of ecological environment. However, the synthesis of polyacrylonitrile always involves toxic surfactants, the use of extra additives undoubtedly increases the synthesis complexity, and cost, and poses potential hazards to the environment. Polyacrylonitrile nanoparticles were prepared by emulsion polymerization of acrylonitrile in a continuous aqueous phase in the presence of potassium persulfate as initiator and sodium hexadecyl sulfate as emulsifier. In this study, the Central Composite Design (CCD) effective tool was used to optimize the polymerization process. The Response Surface Methodology (RSM) was employed to evaluate the effects and attainment of optimum conditions for narrower particle size through the interaction of operating variables. The response was analyzed by ANOVA. The surface morphology and characterization of the nanoparticles were performed using methods such as transmission electron microscopy and scanning electron microscopy, and the chemical characterization was identified by Fourier transform infrared spectroscopy. Thermogravimetric analysis was applied for quantitative evaluations.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**The development and evaluation of chitosan-coated enzyme magnetic nanoparticles for cellulose hydrolysis.** Heejoon Park, University of North Alabama; Patrick Johnson, Iowa State University.

The recycling capability, colloidal and thermal stability of exo-cellulase, endo- cellulase, and β-glucosidases with magnetic particles (MNPs) were evaluated. Co- precipitation and oxidation of Fe(OH)2 methods were used to fabricate magnetic nanoparticles. Three different enzymes were covalently bound to the surface of MNPs using 3-(aminopropyl) triethoxysilane (APTES) and a common protein crosslinking agent, glutaraldehyde. To evaluate the increase in colloidal dispersion stability, chitosan-coating was applied on MNPs and evaluated through particle settlement tests. The results showed that the chitosan- coated MNPs had 3.7 times higher colloidal dispersion stability than the bare MNPs. X-ray photoelectron spectroscopy (XPS) confirmed each magnetic nanoparticle surface modification step and successful enzyme binding. The optimum bioconjugate ratio in exo-cellulase, endo-cellulase, and β-glucosidases was evaluated, and having a high endo-cellulase bioconjugate in the reaction produced the highest glucose. The bioconjugates showed superior glucose productivity 39.4% at 65°C and 22.2% at 88°C in which the native enzyme is inactivated completely after 5 h of exposure. Recycling stability studies showed approximately 78% of activity was retained after 10 cycles and 32% of activity was retained after 20 cycles. The bioconjugates demonstrated equivalent total product conversions as a single reaction of an equivalent amount of the native enzyme after the 10th cycle this work introduces a novel method for covalently binding individual exo-cellulase, endo-cellulase, and β-glucosidases. These bioconjugates showed superior thermal stability and recyclability. It was also demonstrated that chitosan coating significantly improves the colloidal dispersion stability of bioconjugates. Thus this work validates the use of enzyme-MNP bioconjugates to effectively glucose production and promising technique for eventual continuous biological processes.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**Plasma/Ozone Induced PolyNaSS Graft-Polymerization onto PEEK Biomaterial for Bio-integrated Orthopedic Implants.** CHANDRIMA KARTHIK, University of Alabama at Birmingham; RENJITH RAJAN PILLAI, UNIVERSITY OF ALABAMA AT BIRMIMNGHAM; GERARDO HERNANDEZ MORENO, UNIVERSITY OF ALABAMA AT BIRMIMNGHAM; NAMASIVAYAM AMBALAVANAN, UNIVERSITY OF ALABAMA AT BIRMIMNGHAM; PRABAHA SIKDER, ; VINOY THOMAS, UNIVERSITY OF ALABAMA AT BIRMIMNGHAM .

Owing to its superior bulk mechanical properties, poly (ether ether ketone) (PEEK) has gained popularity over the past 15 years as a metal substitute in biomedical implants. Low surface energy is a fundamental issue with PEEK implants. This low surface energy caused by a moderately hydrophobic surface may be able to inhibit cellular adherence and result in the development of an inflammatory response, which may result in cell necrosis and apoptosis. In this work, plasma and ozone treatments have been utilized to surface activate PEEK and graft ionic bioactive polymer polyNaSS (poly (sodium styrene sulfonate)) successfully on the surface to promote cellular attachment and biomineralization. The main goal of our research has been to find a stable green process for surface modification of PEEK by plasma/ozone approaches to increase PolyNaSS grafting efficiency and biomineralization. To further the field of bioactive orthopedic and dental implant technology, this research attempts to address a significant constraint of PEEK implants while preserving their favorable mechanical properties.

IV. ENGINEERING AND COMPUTER SCIENCE

A Paper Presentation

**Plasma/Ozone Induced PolyNaSS Graft-Polymerization onto PEEK Biomaterial for Bio-integrated Orthopedic Implants.** CHANDRIMA KARTHIK, University of Alabama at Birmingham; RENJITH RAJAN PILLAI, UNIVERSITY OF ALABAMA AT BIRMINGHAM; GERARDO HERNANDEZ MORENO, UNIVERSITY OF ALABAMA AT BIRMINGHAM; NAMASIVAYAM AMBALVANAN, UNIVERSITY OF ALABAMA AT BIRMINGHAM; PRABAHA SIKDER, CLEAVLAND STATE UNIVERSITY ; VINOY THOMAS, UNIVERSITY OF ALABAMA AT BIRMINGHAM .

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IV. ENGINEERING AND COMPUTER SCIENCE

A Paper Presentation

**Design of a solar PV plant for Florence, Alabama.** Wael Al-Kouz, University of North Alabama; Hannah Embrey, University of North Alabama; Alberto Boretti, ; Wael Al-Kouz, University of North Alabama University of North Alabama.

The manuscript outlines a plan for a solar photovoltaic (PV) facility in Florence, Alabama, a region known for its abundant solar energy resources. It presents two potential configurations for the plant: floating and ground-mounted. The ground-mounted configuration, which demonstrated the highest power

output potential, was simulated using System Advisor Model (SAM) software to evaluate the PV plant performance. The results indicate that the chosen Florence site is exceptionally suitable, boasting an annual average capacity factor of 20.3%.

Over a projected 25-year lifespan, the Levelized Cost of Electricity (LCOE) is estimated at 4.12 cents per kilowatt-hour (c/kWh). Additionally, this initiative aligns with Alabama's latest energy policy, which prioritizes increasing the utilization of renewable energy sources. This research can serve as a valuable resource for engineers and designers seeking to comply with the state's energy guidelines.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**PROTOTYPING A SPATIAL ATOMIC LAYER DEPOSITION (ALD) SYSTEM USING A GEAR DRIVE SYSTEM AND PROGRAMMABLE LOGIC CONTROLLER (PLC).** Owen Ellenburg, University of North Alabama; Owen Ellenburg, UNA; Emmanuel Soeren Koum, Ngando; Tegra Kabue, Mubikayi; Nate , Finley ; Ryota , Miyazaki; Dongqing , Pan.

As a vapor-phase bottom-up film deposition technique, Atomic Layer Deposition or (ALD) is operated by alternately injecting two or more chemical precursors into a chamber to enable material deposition layer by layer. However, ALD is a very slow process restricted by the fashion of depositing materials layer by layer at atomic level. To solve this issue, the faculty-student team has been devoted to developing a faster spatial ALD system reactor. In this poster, the team presents the work of implementing two improvements to the current metallic prototype. The mechanical improvement is to replace the belt-pulley driven system with a more compact gear-box system. The new power transmission system increases the speed of the driving system and reduces the lag issue of the belt system. The electrical improvement is to use a Programmable Logic Controller (PLC) to control multiple components in the project. The major benefit of using PLC is its expandability with more inputs and outputs as required by the system. The team researched the different types of PLC controllers, and a controlling diagram and program was developed to integrate the different components of the spatial ALD system, and testing has been implemented

IV. ENGINEERING AND COMPUTER SCIENCE

A Paper Presentation

**A machine learning-assisted approach for the Prediction of 3D Printing Parameters with their scaffold design for Periodontal Tissue Engineering Scaffolds.** Rakesh Pemmada, University of Alabama at Birmingham .

The dataset used in the research is an extensive set of original and augmented data amounting to 2741 samples. In it, different 3D printing parameters and outcomes were explored. In this study, five machine-learning models are used: Random Forest, Decision Tree, Logistic Regression, Support Vector Machine, and XGBoost for the forecast of pre-printing scaffold quality and efficiency for 3D printers. All machine learning models were evaluated by ROC and AUC scores using the 10-fold cross-validation approach; RF and XGB outperformed all other models, with superior performance in both cases. The consistently high AUC scores, close to 1.0, indicate excellent model accuracy. Moreover, such models save time and effort in experimental setup because there would otherwise be less manual testing and iterative adjusting. The machine learning could be integrated with 3D printing in periodontal scaffold treatments to meet the specific needs of patients by increasing the quality and efficiency of the scaffolds. These findings create opportunities for the fabrication of better scaffolds to improve functionality in their application in therapies

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**Performance Evaluation of Multi-foci Information from Fresnel Zone Plate.** Nagi Buaossa, University of North Alabama; Monish Chatterjee, University of Dayton.

The parallel chiral slab studied earlier for its spectral/resonant properties, is re-designed into a chiral Fresnel zone plate (FZP) for studying its controllable/tunable imaging properties. A Fresnel zone plate (FZP) lens creates a focus by constructive interference of waves diffracted through open annular zones. The basic operation principle of FZP is based on the interference phenomenon, which is designed to provide a focused spot on the optical axis in the case of a normal incidence. However, the interference condition is not perfect and results in a set of aberrations, mainly including off-axial comatic and spherical. Given the lens-like property of the FZP, additional examinations of the response of the 3 types of FZPs studied corresponding to (object) transparency placements in front of the lens at varying distances are carried out numerically to examine (primarily) image formations at specific locations to the right of the lens. Since an FZP possesses multiple foci by design (based on the (rm) zone radii), for any object placement, no unique real image can be obtained, since there will always be defocused EM waves. Such defocusing effects are studied in some detail to find optimal conditions for reduced defocusing, and also the image clarity and magnification corresponding to the different focal distances via the use of cross-correlation products and mean-squared error measurements. A magnetic, chiral Fresnel zone plate is introduced via an analytic and numerical methodology for examining its imaging and tuning properties including effects of transverse defocusing of superposed waves due to the multiple foci.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**Implementation of Fast Fourier Transform (FFT) and Discrete Fourier Transform (DFT) in Noise Filtration using MATLAB.** Mauyon Wusu, Alabama A&M University; Alak Bandyopadhyay, Alabama A&M University Alabama Agricultural and Mechanical University.

From simple everyday interactions with technology such as video-calling one's family to advanced biomedical and audio applications, one is constantly surrounded by a wide range of signals. This research explores Digital Signal Processing, which is the processing of digitized discrete-time sampled signals, and its specific applications in noise filtration using specialized algorithms. In Digital Signal Processing, noise filtration is of critical importance as many applications require high signal clarity and accuracy. This research focuses on the comparative analysis and implementation of the theoretical knowledge of Fast Fourier Transform (FFT) and Discrete Fourier Transform (DFT) in noise filtration using MATLAB. Both transforms are used to convert time-domain signals into their frequency-domain equivalent signals. However FFT is mainly implemented as FFT is an optimized algorithm for computing DFT and offers significant improvements in computational time and efficiency, making it ideal for real-time noise filtration. MATLAB is used in this research as it provides a comprehensive set of specialized toolboxes for signal processing and allows for customizable data visualization, allowing the implementation and analysis of the signal data to be efficient. Ultimately, this research evaluates the signal-to-noise ratio (SNR), and the findings are used to demonstrate the implementation, advantages and disadvantages of FFT and DFT in noise filtration using MATLAB.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**Characterization of biomaterials derived from Industrial hemp Fibers.** Queen Abbah, Tuskegee University; Emily Amenyenu, Tuskegee University; Desmond Mortley, Tuskegee University; Byungjin Min, Tuskegee University.

Characterization of biomaterials derived from Industrial hemp Fibers

Q. Abbah*, Department of Food and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088; E. Amenyenu, Department of Food and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088; D. Mortley, Department of Agricultural and Environmental Sciences, Tuskegee University, Tuskegee AL 36088; B. Min, Department of Food and Nutritional Sciences, Tuskegee University, Tuskegee, AL 36088.

In recent studies, plant-based agricultural biomass residues such as sugarcane bagasse, rice husk and crop waste have been highlighted as one of the potential sustainable agricultural by-products. In this study, we investigated properties of cellulose derived from two varieties of industrial hemp residues (Henola and Bialobrzeski varieties) which were grown in Tuskegee University farm. The dry matter of industrial hemp hurds fibers were decorticated by mechanical process and ground with milling process. To remove non-cellulosic components from industrial hemp hurds fibers, alkaline treatment with sodium hydroxide was applied. After alkaline treatment, followed by neutralization with washing and drying, the yield of cellulose was approximately 62%. Properties of fiber samples obtained before (BBF and HBF) and after the cellulose extraction (BBCF and HBCF) were examined using X-ray photoelectron spectroscopy (XPS), thermogravimetric analysis (TGA), and scanning electron microscopy (SEM). The XPS analysis exhibited peaks of carbon (C), oxygen (O) and nitrogen (N) as well as other smaller peaks of minerals such as Na, Ca and P. The TGA results showed celluloses of hurds fibers are thermally stable and the SEM images showed that the alkaline treatment had contributed to the degree of disintegration of complex fiber structure. It is suggested that the further study is needed to improve efficiency of purification process of cellulose extraction.

Keywords: Industrial hemp, hurds fiber, extraction, characterization, biomaterial.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**Metal-Doped Semiconductor Plasmonic Optoelectronic Switch.** Mayra Schliemann, Troy University; Raj Vinnakota, Troy University.

We introduce an electro-optic modulator built on a Metal-Semiconductor (M-S) junction, engineered to enable functional plasmonic circuits by actively modulating surface plasmon polaritons (SPPs) at the interfaces of M-S materials. To assess the device's performance, we carried out extensive self-consistent multi-physics simulations, incorporating electromagnetic, thermal, and current-voltage (IV) analyses, with a focus on Germanium (Ge)-based Schottky contacts. These simulations provided critical insights into bias-dependent SPP modulation and switching times, aimed at improving optical confinement and operational speed. The results revealed exceptional device performance, achieving signal modulation beyond -28 dB, responsivity over -1800 dB/V, and switching rates reaching 8 GHz, which suggests data rates above 16Gbit/s. These findings pave the way for utilizing Schottky junctions as active elements in the development of plasmonic-integrated circuits.

IV. ENGINEERING AND COMPUTER SCIENCE

A Poster Presentation

**Flexible Silver/Polyaniline Schottky Diodes on Polyethylene based Elastomer: A Sustainable Approach for Advanced Electronics.** David Summerlin, Troy University; David Summerlin, Troy University; Raj Vinnakota, Troy University; Arun Ghosh, Troy University; Shaimum Shahriar, Troy University .

This study investigates the design, fabrication, and characterization of a flexible Schottky diode utilizing polyaniline (PAni) as the semiconductor, silver as the electrode, and Poly (ethylene-co-methyl acrylate-co-glycidyl methacrylate) (PE-MA-GM) as a recyclable elastomeric substrate. Despite employing non-standard fabrication techniques, preliminary results indicate promising electrical performance, including rectifying behavior, thermal stability, and mechanical resilience under bending, highlighting its potential for sensor and wearable applications. The integration of PE-MA-GM as a sustainable substrate aligns with global efforts to reduce electronic waste, offering an environmentally friendly alternative for flexible electronics. This work lays the foundation for future advancements in sustainable device fabrication, optimization of performance, and broader applications in next-generation wearable and eco-conscious technologies.

IX. HEALTH SCIENCES

A Poster Presentation

**Comparative Analysis of Two Traditional Antibiotics on bacterial isolates from Galbraith Mill Creek Watershed.** Garrett Orr, Faulkner University; Avery Vasquez, Faulkner University; Uduak Afangideh, Faulkner University .

Since medicinal antibiotics were discovered almost a century ago, they have slowly become more prevalent in the environment allowing for bacteria to develop antibiotic resistance. Before medicinal antibiotics were discovered, traditional medicine was often used to treat infections. This study evaluates the antibacterial effectiveness of two traditional antibiotics, garlic (Allium sativum) and Aloe vera against Escherichia coli and other coliform bacteria isolated from Galbraith Mill Creek Watershed. Sterile paper discs were used to measure the zone of inhibition and determine the antibacterial efficacy of the two traditional antibiotics over the course of time. Garlic demonstrated significant ($p < 0.05$) antibacterial activity against all coliforms, particularly against E. coli, with the zones of inhibition increasing steadily from 12 hours to 36 hours. Aloe vera showed almost no antibacterial activity with the zones of inhibition remaining at the baseline measurement throughout all time intervals. These results highlight the antibacterial properties of garlic compared to aloe vera and suggest the use of garlic as a possible antibacterial alternative for water quality management.

IX. HEALTH SCIENCES

A Poster Presentation

**Health Outcomes among Sexual and Gender Minority Adults in the Deep South.** Penelope Robin, University of Alabama at Birmingham .

Knowledge regarding health outcomes among the sexual and gender minority (SGM) population is lacking. Existing research illustrates that mental health issues and psychological comorbidities are common, but little is known about physical and medical health outcomes. This study aims to fill the research gap by evaluating common comorbidities and physical health outcomes in the SGM population. This research project will identify disease burden of different subgroups of the SGM population and the prevalence of specific diseases in these subgroups using two common assessments: the Elixhauser Comorbidity Index and the Charlson Comorbidity Index. Electronic health record data from the Magic City Wellness Center (MCWC) on demographics and diagnostic codes (ICD-10 codes) will be used in this analysis. This study is a work in progress; the data from the MCWC is currently being analyzed by our statistical collaborators. This investigation will provide insight into health concerns among different segments of this underserved population, which could inform future research aiming to reduce health disparities experienced by the SGM community.

IX. HEALTH SCIENCES

A Poster Presentation

**Inhibition of cAMP-phosphodiesterase 4 (PDE4) protects from lipopolysaccharide-induced salivary gland dysfunction in mice..** Jackson Miller, University of South Alabama; Abigail Boyd, University of South Alabama; Wito Richter, University of South Alabama; Zach Chancey, University of South Alabama; Edward Fiedler, University of South Alabama ; Daniel Irelan, University of South Alabama .

Saliva is essential for oral health as evidenced by the severe impairments suffered by patients with salivary gland dysfunction, which include xerostomia (the feeling of dry mouth), difficulty chewing, swallowing, or digesting food, and oral infections. Current treatments, such as muscarinic agonists or saliva substitutes, are effective in only a portion of patients and often provide only short-term relief, highlighting a need for novel therapeutics. We have shown previously that inhibition of Type 4 cAMP-phosphodiesterases (PDE4s), a group of isoenzymes that hydrolyze the second messenger cAMP, stimulates saliva secretion in healthy mice. Here, we used a model of lipopolysaccharide (LPS)-induced salivary gland dysfunction in mice to test whether targeting PDE4s is also effective in alleviating pathologic hyposalivation. A 6-h treatment of mice with LPS triggered systemic- and salivary gland inflammation, as reflected by increased levels of proinflammatory cytokines, and impaired saliva secretion measured under anesthesia in response to muscarinic- or beta-adrenergic stimulation. In mice treated with LPS for 6 h, treatment with the PDE4 inhibitor Roflumilast induced an acute, visible salivation in awake mice suggesting that PDE4 inhibition remains effective in inducing saliva secretions in settings of pathologic gland dysfunction. Moreover, pretreatment with Roflumilast alleviated the LPS-mediated impairment of saliva secretion in response to muscarinic- or beta-adrenergic stimulation in anesthetized mice and reduced the levels of proinflammatory cytokines. These findings suggest that PDE4 inhibition may alleviate both the causes (i.e. inflammation) and symptoms (i.e. xerostomia) of salivary gland hypofunction and, thus, represents a promising therapeutic approach.

IX. HEALTH SCIENCES

A Poster Presentation

**Axillary Nerve Innervation of Long Head of Triceps in Student Dissected Cadaver.** Caulkins Mark, Samford University; Fiona Buttrum, Samford; Dasha Cherepovitsky, Samford; Emma Grace Clark, Samford; Victoria Cook, Samford ; Anna Virginia Fagan, Samford; Rebecca Howard, Samford.

The three heads of the triceps muscle are usually innervated by branches of the radial nerve. Less commonly, the long head of the triceps is innervated by a branch of the axillary nerve, and the lateral and medial heads by the radial nerve. This pattern has been noted to be present in 6.2% to 26.7% in cadaveric dissections. This anomaly was noted in a student dissected cadaver at the Samford University Human Cadaver Laboratory.

IX. HEALTH SCIENCES

A Poster Presentation

**Epidural Hematoma with Craniotomy.** Mark Caulkins, Samford University; Lauren Elliott, Samford; Kayla Hill, Samford; Hope Jiles, Samford; Tyler Reason, Samford ; Olivia Trafazoli, Samford .

A cadaver dissected by Physician Assistant Students was noted to have a right temporal craniotomy, with a triangular 2 cm by 3 cm section of right temporal bone removed surgically. The overlying surgical incision was not completely healed, so this surgery was performed a short period of time before death. There was an epidural hematoma deep to the craniotomy. The underlying brain was compressed by the hematoma.

IX. HEALTH SCIENCES

A Poster Presentation

**Polycystic Kidney and Forearm Arteriovenous Fistula in Student Dissected Cadaver.** Mark Caulkins, Samford University; Susanne Bouler, Samford; Carly Dyer, Samford; Sara Janss, Samford; Julia Stoner, Samford ; Sara Kate Thomas, Samford; Brad Cantley, Samford.

Polycystic kidney disease was noted in the right kidney of a student dissected cadaver. The left kidney was normal. An arteriovenous shunt was also noted in the left forearm, presumably for access for renal dialysis.

IX. HEALTH SCIENCES

A Poster Presentation

**Left Frontal-Temporal Craniotomy, Healed with Three Small Plates.** Caulkins Mark, Samford University; Elizabeth Bradley, Samford; Lindsey Fisher, Samford; Jonathan Greganti, Samford; Lauren Pritchett, Samford .

A left frontal-temporal bone craniotomy measuring 4 cm by 6 cm was noted in a student dissected cadaver. The removed bone was replaced, and secured by 3 small 2-hole plates and screws. The bone was noted to be healed. The underlying brain showed compression, most likely by an associated epidural hematoma.

IX. HEALTH SCIENCES

A Paper Presentation

**Cadaver Anomalies in *G Cadaver Dissection- 2025.** Mark Caulkins, Samford University; Nicholas Washmuth, Samford; Scogin William, Samford .

Cadaveric dissection has long been a part of the education and training for students in medicine. It allows appreciation of the three-dimensional structure and different textures of the human body. It has particular utility in the education of future clinicians such as surgeons, physician assistants, physical therapists, and occupational therapists.

One of the advantages of cadaveric dissection is studying the anomalies found in every cadaver.

We present some of the interesting anomalies found in the upper extremity peripheral nerve anatomy of cadavers dissected at the Samford University Human Cadaver Lab.

IX. HEALTH SCIENCES

A Paper Presentation

**Use of Transcranial Direct Current Stimulation for Improvement of Symptoms of Depression: Focus on Improving Verbal Fluency.** Jack Shelley-Tremblay, University of South Alabama; Celeste Reames, Reames University of South Alabama .

Anodal tDCS over Broca's area has been shown to improve phonemic and semantic verbal fluency in neurologically unimpaired individuals (Cattaneo et al., 2011). tDCS is a non-invasive tool that has been shown to temporarily modify behavior,as well as facilitate learning and task performance in healthy individuals (Thair et al.,2017). The current study utilized high definition tDCS, which is defined as having one central electrode (the anode over F3) referenced to four surrounding electrodes (cathodes over Fp1, Fz, C3, and F7), which produces a more focal electric field and limits the spreading of activation for 15 participants with mild to moderate levels of self reported depressive symptoms. Verbal fluency was assessed with the DKEFS system. Results indicate some promising responses in verbal flency for some participants, but not all. The stimulation was well-tolerated by 14/15 participants. Future studies should seek to identify characterists assocated with responders and non-responders.

IX. HEALTH SCIENCES

A Paper Presentation

**Surgical Implants Found in Student Cadaver Dissection-2025.** Caulkins Mark, Samford University; Nicholas Washmuth, Samford; Scogin William, Samford .

Cadaveric dissection has long been a part of the education and training for students in medicine. It allows appreciation of the three-dimensional structure and different textures of the human body. It has particular utility in the education of future clinicians such as surgeons, physician assistants, physical therapists, and occupational therapists.

One of the advantages of cadaveric dissection is studying the anomalies found in every cadaver.

We present some of the surgical hardware found in cadavers dissected at the Samford University Human Cadaver Lab.

Special 1. Alabama Honors Scholars

A Poster Presentation

**Brick by Brick: A Biological Lego Set.** Lucy Orr, University of South Alabama .

Protein phosphatase 5 (PP5) has been correlated to tumor cell reproduction when overexpressed. An opportunity to develop a prodrug to inhibit the PP5 catalytic activity exists. Folic acid has shown success in inhibiting PP5, making it a promising candidate when targeting tumor cells. While folic acid is a complex molecule with unique physical properties, our hypothesis is to systematically probe the subunits of folic acid. Upon covalently linking each subunit to norcantharidin our plans are to assess efficacy of each subunit's inhibition when and docked within the PP5 active site and surrounding areas.

Special 1. Alabama Honors Scholars

A Poster Presentation

**Mirror Mirror on The Wall Who Is The Most Active of Them All.** Caleb Lopansri, University of South Alabama; David Forbes, University of South Alabama; Mary Helene Marmande, University of South Alabama; Bailey Baxter, University of South Alabama.

Protein Phosphatase 5 (PP5) is a serine/threonine phosphatase that regulates cell signaling pathways, suppressing growth or inducing apoptosis in response to genetic stress. Overexpression of PP5 has been linked to the progression of certain cancers, including human breast cancer and mouse leukemia, highlighting its potential as a therapeutic target. Cantharidin, a natural toxin, and its demethylated derivative, norcantharidin, have shown promise as PP5 inhibitors. Structural modifications of norcantharidin have revealed that derivatives substituted at position five exhibit stereospecificity, impacting inhibitory potency. Stereospecific derivatives have been synthesized using Cinchona alkaloids for desymmetrization, demonstrating variable efficacy. Preliminary results indicate that Cinchonidine-derived products show lower inhibition compared to Cinchonine-derived counterparts. These findings suggest that optimizing stereospecificity can improve PP5 selectivity, paving the way for next-generation inhibitors to suppress cancerous cell growth in breast cancer and leukemia.

Special 1. Alabama Honors Scholars

A Poster Presentation

**Small Particles, Big Impact: Reengineering Lipid-Like Nanoparticle Synthesis.** Bailey Baxter, University of South Alabama .

Lipid-like nanoparticles (LLNPs) are innovative drug delivery systems that encapsulate mRNA, protecting it from physiological degradation. Despite their clinical success, current LLNP assembly methods involve multiple synthetic steps, presenting opportunities for optimization. A streamlined synthetic approach for LLNP assembly was explored by diversifying carboxylic acid derivatives through the Curtius rearrangement. Model systems were utilized to synthesize ureas, amides, and carbamates, which serve as key components in LLNP structures. Notably, an unexpected byproduct from an attempted rearrangement involving benzylamine was isolated and characterized, underscoring the reaction's complexity. Successful synthesis of a carbamate derivative using cyclohexane carboxylic acid demonstrated a reduction in synthetic steps by half. This research was conducted within a course-based undergraduate research experience (CURE) CH 490-H, fostering hands-on engagement in medicinal chemistry. These findings highlight the utility of Curtius rearrangement for developing LLNP components while advancing efficient synthetic protocols in drug delivery systems.

Special 1. Alabama Honors Scholars

A Poster Presentation

**Evaluating Potential for Three Antibiotic-resistant Bacteria to Contaminate Thermoplastic Materials Used to Construct Externally Worn Patient Medical Devices.** Dev Mehta, University of South Alabama; Terrence Ravine, University of South Alabama; Catherine Brock, University of South Alabama .

This project focused on determining how differences in hydrophobicity (wetting) of thermoplastics used to construct immobilizing patient orthotic (splint) devices would affect attachment of three antibiotic resistant (AR) bacteria. Tested bacteria included vancomycin-resistant (VRE) Enterococcus faecalis, methicillin-resistant Staphylococcus aureus (MRSA), and extended-spectrum beta-lactamase (ESBL) Escherichia coli. All three bacteria are major human pathogens causing healthcare-associated infection (HAI) that develop during patient treatment. This investigation is very prominent as it directly correlates to patient safety and well-being. Contaminated orthotic splints can pose a great danger of severe bacterial infection and can result in preventable consequences for patients. Splint contamination with AR bacteria is even more significant since it severely limits available patient treatment options. It was hypothesized that measured differences in 3 thermoplastic materials hydrophobicity will greatly affect initial attachment. One of my prior experiments has shown me the significance of the transmission of HAIs from thermoplastic medical devices to patients. According to the Center for Disease Control and Prevention “On any given day, about one in 31 hospital patients has at least one healthcare-associated infection.” The project focused on generating a better understanding of HAIs related to thermoplastic materials in producing a variety of medical devices, including orthotic splints. Specifically by looking at how material hydrophobicity affects adherence and adhesion of infective AR bacteria. This experiment intends to put routine cleaning techniques into question, with an emphasis on prioritizing patient safety by the means of mitigating potential causes of infection.

V. SOCIAL SCIENCES

A Paper Presentation

**Do Variations of Cognitive Empathy Influence Susceptibility to the Intentionality Bias?.** David Willard, University of South Alabama; Joshua Foster, University of South Alabama.

The purpose of our study was to replicate a recently published study showing a strong positive correlation between cognitive empathy and intentionality bias, suggesting that individuals with higher cognitive empathy might be more prone to over-attributing intentionality to the actions of others. Our study used a substantially larger sample (N = 594) and additional empathy measures to assess the reliability of this finding. Contrary to the original study, our results indicated a significant negative correlation between cognitive empathy and intentionality bias, particularly in scenarios involving prototypically accidental actions. This suggests that individuals with higher cognitive empathy are actually less likely to exhibit intentionality bias. Our findings challenge the findings of the original study and represent, in our opinions, a more parsimonious account that is more consistent with prior theory and research on intentionality bias. Further research is, of course, needed to clarify which account is correct and explore whether there are moderating circumstances that may affect correlations involving cognitive empathy and judgments of intentionality.

V. SOCIAL SCIENCES

A Paper Presentation

**AAS Presentation Title: Science of Literacy Simple View of Reading : Does it improve reading achievement work for struggling learners?.** Dana Wilchcombe, Alabama A&M University Oakwood University.

Abstract

The science of reading is a vast, interdisciplinary body of scientifically based research about reading and issues related to reading and writing. Science of reading research studies suggest that a student's reading comprehension score can be predicted if decoding skills and language comprehension abilities are known and remediated. The Simple View of Reading formula has two basic components: word recognition (decoding) and language comprehension. This investigation will determine if the use of the simple view of reading learning experiences improves struggling learners reading achievement through 10 weeks of reading remediation. Teacher candidates in the required reading remediation course will provide one to one tutoring and complete a remediation case study to gain an understanding of underlying reasons, opinions, and motivations. Teacher candidate remediation case studies will be used as the primary document to analyze the use of the Science of Reading use of the Simple View of Reading formula . Quantitative data will be used to determine if the use of Simple View of Reading is impactful for student achievement in literacy. Results indicate that, while teacher candidates place a greater emphasis on the Simple View of Reading word recognition component and less emphasis on language comprehension there is overall achievement in the use of the Science of Reading research components of the simple view of reading.

Key words: Scarborough reading rope, science of reading ,simple view reading, informal reading inventory,

V. SOCIAL SCIENCES

A Poster Presentation

**The Role of Narcissism in Eyewitness Misidentification.** Haley Hearn, University of South Alabama; Andrew Elmore, University of South Alabama; Isabella Palmieri, University of South Alabama; Joelle Zoghby, University of South Alabama; Joshua Foster, University of South Alabama .

According to the Innocence Project, 69% of individuals exonerated by DNA evidence were originally convicted based on eyewitness misidentification. One way that detectives try to prevent misidentification is to assess how confident eyewitnesses are in their identifications. There is a large body of research suggesting that these confidence estimates can in many instances operate as reliable barometers of accuracy. However, what if an eyewitness is overconfident by nature? Narcissism is a personality trait characterized by overconfidence. When narcissistic eyewitnesses report confidence in their identifications, should their reports be trusted? The present study aims to test this by measuring narcissism in a sample of participants and having them complete a face-memory test. Following each trial of the test, participants will report how confident they are in their response. The hypotheses are that narcissistic participants will report greater confidence in their identifications, even though their accuracy will be no better than participants with lower narcissism levels.

VI. ANTHROPOLOGY

A Paper Presentation

**Mortal Imperatives: How Death Doulas Guide Others Through the End of Life.** Amy Shields, University of Alabama at Birmingham .

Death is the one certainty in human life, and every culture has unique ways of engaging with this universal experience. In the modern, industrialized West, the prevailing attitude is one of avoidance. Death doulas--also called end-of-life doulas, death midwives, or death walkers--are non-medical professionals who seek to change that attitude and to teach people how to approach death as a natural transition, one that can impart emotional and spiritual growth for dying people and their caregivers. Although the profession of death doula only recently emerged in the West, their role mirrors multiple aspects of care and companionship for the dying that feature in many traditional cultures and religious traditions. Through interviews with death doulas across the US, this research investigates their philosophies, techniques, and motivations to help people experience a good death. Their first-hand accounts illuminate the legal and practical challenges facing death doulas, and the research examines aspects of death work, including the politics of care and legitimacy and attitudes regarding gender in caring professions.

VI. ANTHROPOLOGY

A Paper Presentation

**Agricultural crisis: Meeting food demand with sustainable practices.** Julie Gonzalez, University of Alabama at Birmingham .

Agriculture today is severely affected by climate change and the increasing global demand is adding pressure on the implementation of new strategies. Recent studies suggest that the current growth of major crop productivity will not meet the necessary targets to measure up to the expected population increase. Additionally, the rising rate of global temperature has posed a risk on agricultural production systems, resulting in weather conditions that our crops are not adapted to withstand. Some researchers have suggested further modifying crops through selective breeding or genetic engineering to withstand the pressures of climate change. Although, this does not create a sustainable solution to the agricultural crisis. My research explores nature-positive production practices and indigenous knowledge for sustainable crop production.

VI. ANTHROPOLOGY

A Poster Presentation

**Foodways from the Roman Harbor Vada Volaterrana.** Stephen B Carmody, Troy University; Gabrielle Purcell, Troy University; Madisen James, Troy University; Gage Allen, Troy University Troy University.

The importance of the Vada Volaterrana harbor system has been well-documented in the historical literature for thousands of years by classical writers such as Cicero, Plinius, and Pliny the Elder. Established in the 7th century BC as the harbor system of the Etruscan city of Volterra and expanded during the Roman era to include a system of docks, pottery factories, and farms, the harbor was used extensively until commercial activities ended in the late 7th century AD. Since 1980, excavations conducted by the University of Pisa have uncovered approximately a quarter of the harbor system, including a large warehouse, a small thermal bath, a fountain/waterhole, a large water tank, a public thermal bath, and the head office of the guild that ran the port's everyday operations. In the summer of 2019, Troy University and the University of Pisa formed a collaborative research project to begin detailing the foodways of the site's inhabitants. Our archaeological efforts have focused on a large rectangular building of seven rooms that dates to the end of the 1st century AD. Between 2019 and 2024, flotation samples were excavated and processed to collect carbonized plant and animal food remains from the site. Samples were collected from multiple rooms, different occupational sequences, and inside and outside of the structures to detail changing subsistence strategies over time and across space. Here, we detail our collection activities and preliminary results to describe the day-to-day life and subsistence activities of the men, women, and children who occupied the site.

VII. STEM EDUCATION

A Paper Presentation

**Does Instructor- generated resources impact student academic performance? A case study in a Non-Majors Biology Course.** Uduak Afangideh, Faulkner University .

Enhancing student learning is a primary objective for professors in higher education. Despite advancements in teaching methodologies, traditional science textbooks often fail to significantly improve student engagement and outcomes. This study investigates the impact of instructor-created resources, which integrate subject matter expertise and personalized teaching philosophies, on student learning in a non-majors biology course. Over six semesters, data from 403 students were collected and statistically analyzed to evaluate differences in academic performance and attendance, between classes using traditional textbooks and those using an instructor-created textbook. The results revealed statistically significant improvements in academic performance ($p < 0.05$) among students who used an instructor-generated textbook. Post-class surveys utilizing a 5-point Likert scale indicated student satisfaction and positive feedback with regard to student engagement, collaboration and peer support in the group that used the instructor-created textbook. Grounded in active learning and constructivist pedagogical theories, this study underscores the potential of tailored instructional materials to bridge gaps in traditional content delivery. By reflecting the instructor's teaching philosophy and addressing specific classroom needs, such resources can enhance student outcomes and foster a more engaging learning environment. The findings highlight the importance of rethinking textbook development in science education and suggest that instructor-designed materials could serve as a model for improving student success in various disciplines. Future research could explore broader applications and long-term impacts.

VII. STEM EDUCATION

A Poster Presentation

**Career Readiness Book Club Enhances Student Success for Community College Transfer Students.**
Malia FIncher, Samford University; Greg Kawell, Samford University; Betsy Dobbins, Samford University; Randolph Horn, Samford University.

The Samford SSTEM Program, funded by the National Science Foundation, aims to support academically qualified students with demonstrated financial need, including community college transfer students and Samford juniors and seniors, in pursuing STEM disciplines. A core focus of the program is addressing barriers to STEM persistence, particularly for underrepresented groups, including academic readiness, sense of belonging, STEM self-identity, financial challenges, mentoring quality, self-efficacy, and career preparedness.

The program's objectives include improving academic success, fostering peer and mentor networks, retaining students in STEM majors, enhancing career readiness skills, facilitating research and internship opportunities, increasing degree completion rates, preparing students for competitive graduate programs, and supporting long-term retention and promotion in STEM careers.

To achieve these goals, we implemented a two-semester cohort-based course model for transfer students, incorporating career readiness workshops and a book club format. Junior and senior peer mentors participate alongside new students, fostering a supportive and collaborative environment. Assessment of self-reported attitudes revealed significant improvements in students' self-efficacy, sense of belonging in STEM, and confidence in their STEM skills. Consistent increases in these measures were observed following participation, alongside a notable improvement in graduation rates.This program demonstrates the effectiveness of targeted interventions in overcoming barriers to STEM persistence and preparing students for success in STEM careers.

VII. STEM EDUCATION

A Paper Presentation

**Evaluating the Effectiveness of an Integrative Education Implementation in Biology Classrooms on Increasing Student Sense of Belonging.** Christel Whitehead, University of Alabama at Birmingham .

Research has demonstrated that students who are able to see the real-world application of their classroom experience are more engaged and have a more positive attitude regarding learning the material. This study focuses on taking student learning beyond textbook knowledge of the STEM disciplines by integrating reflection journal usage in the classroom with the purpose of better preparing students to connect STEM knowledge to its application beyond the classroom. Merging student interests with the curriculum and classroom experience can enhance student engagement and result in an increase of cognition and retention. This study compares lower-level *Us enrolled in introductory biology laboratory sections at University of Alabama at Birmingham, giving us insight into how students view the relationship between science and the real-world. The experimental journal assignments contain questions that guide students to the correlation between the material and application. Pre-and post-surveys will be utilized as a method of measuring the change in students' attitude toward the relationship between science and society. The study hopes to demonstrate that simple but deliberate modifications of methodological approaches, such as reflection journal usage, by instructors can have significant impacts on their students' approach, attitude, and application of textbook knowledge to create more well-rounded individuals.

VII. STEM EDUCATION

A Poster Presentation

**A comparison of prenatal care in United States and Germany, Italy, Switzerland.** Elizabeth McMahan, Troy University; Janet Gaston, Troy University Troy University.

In the fall of 2021, Troy University's College of Arts & Sciences (CAS) launched a Global Scholars Program to increase participation of Troy students in research abroad, professional development, and global awareness. Troy faculty lead study abroad trips that allow participants and other students to explore new destinations and answer their research questions. In May 2024, Global Scholars interested in healthcare were given the opportunity to study abroad in Italy, Germany, and Switzerland. Excursions were planned to focus on healthcare systems and cultural landmarks to give students an overview of European healthcare and culture. Before going on the trip, all students demonstrated their knowledge of healthcare in the United States in an online Special Topics in Biology course. The Global Scholars in the group selected research questions specific to their own career goals and interests, using literature review to prepare for their experience abroad and inform their findings. One study compared prenatal care in the United States to prenatal care in the countries visited to identify differences in the treatment of pregnant women and to assess which healthcare system may provide better patient outcomes. Prenatal data in the United States were compared to data from Germany, Italy, and Switzerland using observations made abroad and existing online sources. Although no significant results were found, the study reinforced the importance of maternal healthcare in the United States and Europe and highlighted the need for improvement in all healthcare systems. Abroad experience of a Global Scholar will be presented.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Paper Presentation

**An Overview of the Creation of the Oyster Habitat Suitability Model for All Tidal Shorelines in Choctawhatchee Bay, Florida.** Chris Boyd, Troy University; Xutong Niu, Troy University; Rose Horn, St. Andrew and St. Joseph Bays Estuary Program .

The “Choctawhatchee Bay Oyster Habitat Suitability Model” and associated web-viewer was created to provide state, federal, and non-governmental natural resource managers, with a readily available online source to assist the user to successfully evaluate oyster (Crassostra virginica) site suitability for specific locations in Choctawhatchee Bay, Florida. This model considers multiyear water quality data, bay bottom compaction, optimum oyster habitat suitability model analysis results, and other environmental factors. The Choctawhatchee Bay Habitat Suitability Model used five parameters that were assigned biological weight factors based on a comprehensive literature review for oyster water quality optimums for both larvae, pre-juvenile, juvenile, and adult oysters along with discussions with oyster experts from the Gulf of Mexico region. The five parameters include pH, bottom dissolved oxygen, bottom salinity, maximum water temperature, and bay bottom hardness. Additional water quality data sets that were acquired and/or collected by the project team included nitrate, total nitrogen, turbidity, Enterococci, alkalinity, and color. Additional data layers added to the web-viewer include shoreline, bathymetry, artificial oyster reef/constructed living shorelines, historical oyster reefs, and open versus closed water data. The author will present how data was acquired, created, and input into the model. In addition, the biological and chemical model parameter weight values will also be discussed along with how to access the model. Furthermore, the authors will discuss future research and data needed to improve the Choctawhatchee Bay Oyster Habitat Suitability model to better assist the user with on and off-bottom oyster reef prospective project site selection.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Paper Presentation

**AI-Assisted Modeling for Predicting Polyethylene Contamination Level in Recycled Polypropylene with Raman Spectrometry.** John Long, Troy University; Caleb Chatfield, Troy University; Shaoyang Liu, Troy University .

Spectrometry is a powerful tool for identifying and quantifying the components of a material non-destructively. However, it generates a large amount of data, forcing a trade-off between analyzing smaller portions for faster results with reduced accuracy or comprehensive analysis requiring significant time investment. Recently, chemometrics development provides various modeling tools to handle complex spectrometric data and accurately predict the component's content. However, complicated coding and modeling skills are required to carry out these analyses. This study investigates the potential of AI to generate code for more efficient spectrometry analysis to aid those without coding expertise. This would increase the amount of data analyzed while lowering the time needed due to AI's assistance, allowing for faster and more accurate sample analysis. Leveraging AI programs (Google Gemini and ChatGPT) within the R-Studio environment, students with no prior coding experience generated and debugged code for both calibration and analysis of spectrometric data. They successfully produced functional code with minimal guidance, achieving accurate analysis results. The AI generated accurate, concise lines of code, with little revision needed to achieve the analysis results from a large set of data. AI was also used to solve and fix any errors that occurred during the coding process and made the process easier for those with little knowledge of code. Minor discrepancies in final values (averaging difference of 2.1%) were attributed to calculation variations between AI-generated code but did not significantly impact the reliability of overall results. This demonstrates the potential of AI to accelerate and broaden access to advanced spectrometric techniques. Future research will focus on streamlining the AI-assisted workflow and enhancing compatibility with diverse spectrometric data types.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**The Necessity of Provenance: Analysis of a peculiar geological specimen from the Collections of the University of North Alabama.** Gregory Buckley, University of North Alabama; Mason Curb, University of North Alabama.

A collection of geology specimens was donated to the University of North Alabama in the Spring of 2024 by a resident of Killen, Alabama. Many of the specimens were identified by the donor as having been collected in northern Alabama and southern Tennessee, although none of the material had associated collection data. Several donated specimens were clearly from outside of the region, such as several pieces of obsidian.

One donated specimen is particularly interesting in that it appears to be the internal cast of an extremely large brachiopod based on its shape, symmetry, and absence of typical shell external morphology. The wing-like shape of the specimen and its extremely large size (24 cm x 32 cm) indicate a potential referral to Gigantoproductus, known from Mississippian Period (360– 320 MYA) of Africa, Asia, and Europe. This would be the first recorded occurrence of this genus in North America.

The lithology of the specimen is similar to the Hartselle Sandstone found throughout northern Alabama, and the Mississippian age of that formation is the same as the known temporal distribution of Gigantoproductus. Unfortunately, the donor of the material had no recollection of where this specimen was collected. The absence of provenance, a recording of the exact location where something was collected, removes any scientific value of this specimen. It does, however, offer a lesson in the importance and necessity of collecting data.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**Is Spring Break Coming Early? Effects of Climate Change on Alabama's Native Plant Phenology.** Kelly Pruitt, Jacksonville State University; Tenzing Ingty, Jacksonville State University.

Is Spring Break Coming Early? Effects of climate change on Alabama's native plant phenology

Climate change has significantly impacted biodiversity, prompting many species to adapt by altering their phenology—the timing of life cycle events. Shifts in plant phenology can have far-reaching ecological consequences, particularly for species that rely on these plants directly or indirectly. One critical consequence is the temporal mismatch between plants and their pollinators, a phenomenon observed in multiple species. Studies using satellite imagery have documented advances in spring phenology across the United States, but species-specific data remain limited, especially in the biodiverse and ecologically vulnerable Southeastern region.

To address this gap, we analyzed historical records from herbarium specimens of native plant species in Alabama. Our dataset consisted of 1,304 specimens from 11 species, spanning 146 years. The analysis revealed that 10 of the 11 species exhibited advanced flowering phenology, with three showing statistically significant correlations ($p < 0.05$) between the day of year (DOY) of flowering and the collection year, as determined by Pearson's correlation.

This study represents the first attempt to leverage herbarium specimens to investigate climate-driven changes in plant phenology in the Southeastern United States. The observed advancements in flowering phenology for most species align with global findings from previous studies. While satellite imagery has highlighted regional trends in spring phenology, its broad spatial scale cannot capture species-specific responses, underscoring the value of our specimen-based approach.

Expanding this research to include more species and specimens would help address key limitations, including the small sample size for certain species.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**Effects of different water treatments on growth of microorganisms in Gailbraith Mill Creek Watershed.** Daisy Neil Sapp, Faulkner University; Myles Boyd, Faulkner University; Uduak Afangideh, Faulkner University .

Ensuring access to safe drinking water remains a critical public health concern, particularly given the global challenge posed by bacterial contamination. This study evaluates the effectiveness of two common water decontamination methods—chlorination and filtration—in removing bacterial contaminants, including potentially pathogenic strains such as Escherichia coli. Laboratory experiments using field water samples from Gailbraith Mill Creek Watershed showed a significant difference ($P < 0.05$) between chlorination and filtration with chlorination, under optimal conditions, achieving 100% bacterial reduction. In contrast, filtration produced more variable results, with higher residual bacterial levels remaining in some samples. These findings highlight the comparative effectiveness of the two methods, with chlorination proving to be the more reliable approach for pathogen removal. Membrane filtration showed potential as a complementary treatment, especially in certain water quality contexts. This study which was done using a bacteriological monitoring kit provided by the Alabama Water Watch provides valuable evidence for optimizing water treatment strategies, underscoring the importance of considering both the strengths and limitations of each method in diverse environmental conditions. The results contribute to the ongoing efforts to improve public health through safe drinking water access and offer guidance for future research and policy development in water treatment technologies.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**Effects of Environmental Conditions on the Growth of Microorganisms in Galbraith Mill Creek.** Ashton McCullar, Faulkner University; Landon Hunton, Faulkner University; Uduak Afangideh, Faulkner University .

Microorganisms are present in aquatic ecosystems, with their growth and survival profoundly influenced by environmental factors like temperature, pH, ultraviolet (UV) radiation, and nutrient availability (Gupta, et al (2016). This study examines the effects of these variables on microbial growth within Galbraith Mill Creek, a tributary of the Alabama River Basin that traverses Elmore, Montgomery, and Millbrook counties, as well as Faulkner University. Water samples from the creek were subjected to variations in pH, temperature, and UV exposure to assess bacterial responses.

Results indicated that temperature gradients significantly ($P< 0.5$) influenced bacterial growth rates, with higher temperatures promoting increased colony growth and recovery, while colder conditions substantially slowed growth. Similarly, variations in pH affected microbial survival, with bacteria exhibiting optimal growth within near-neutral ranges. Growth persisted but was reduced in highly basic (pH 9–10) and acidic (pH 4.5–5.5) environments. UV radiation demonstrated a dual effect, depending on exposure intensity and duration. Prolonged exposure resulted in complete bacterial mortality, while moderate UV exposure facilitated growth in some cases, based on adaptive mechanisms or UV wavelength effects. The results of this study demonstrate that environmental factors such as temperature, pH, and UV radiation significantly ($P< 0.5$) influence microbial growth dynamics. These findings enhance our understanding of the impact of environmental conditions on microbial populations with implications for ecosystem health and water quality management.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**Fish and Crayfish Occurrence in Degraded Streams at the Troy University Arboretum.** Sophie Richards, Troy University; Jonathan Miller, Troy University.

At the Troy University Arboretum, our headwater streams are in a poor state due to the surrounding urban influences as well as years of mismanagement, erosion, and sedimentation. Recent restoration efforts of local habitat at the arboretum are ongoing. This study was conducted to establish a baseline of the streams' current biological state through electrofishing based on presence of fishes and crayfishes. All streams were assumed to be in a poor state due to the historical habitat degradation throughout the system. Through electrofishing six stream sites and two wetland sites throughout the Arboretum, we were able to determine species occurrence. A total of seven fish and two crayfish species were documented at the arboretum. The quality of sites based on fish species improved in downstream reaches. This study suggests that the streams of the arboretum are lacking biological integrity due to historical land use practices as well as ongoing urban impacts and habitat loss. We hope that with continued restoration efforts, more native species will eventually return to the arboretum streams.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**Investigating the predatory behavior of the bumblebee Assassin Snail (Anentome helena) and the potential ecological implications in invaded freshwater systems.** Kathleen Madden, Jacksonville State University; Lori Tolley-Jordan, Jacksonville State University.

The bumble-bee assassin snail, Anentome helena, native to freshwaters of Malaysia, is one of only a few freshwater species in the marine lineage, Neogastropoda, that includes predatory snails such as whelks and cone snails. This snail is widely available in the aquarium trade, tolerant of a wide range of water temperatures, survives adverse transport conditions, and readily reproduces in captive conditions. To date, no invasive populations are reported, and the invasion threat is not-well understood. While anecdotal evidence from hobby aquarists suggest that these snails are voracious, generalist predators of snails; the importance of prey size, prey type, and behavior of predator and prey is insufficiently examined . Visual analyses of assassin snail predation of operculate snails were restricted to aperture widths of less than 10 mm , regardless of snail species. Feeding trials also showed that assassin snails are generalist molluscivores as they readily consumed Asiatic clams. This is a significant finding, as prior to this study, no reports of assassin snails consuming non-snail taxa are documented. Finally, regardless of prey type, time-lapsed filming showed that assassin snails aggregate when hunting, although the association among snails (positive or negative) is unknown. Further research describing assassin snail life-history, environmental constraints, and feeding niche breadth are needed to determine potential injurious impacts on invaded systems.

VIII. ENVIRONMENTAL AND EARTH SCIENCE

A Poster Presentation

**Exploring Oceanic Garbage Patches: Utilizing Dynamic Mode Decomposition for Insight.** Moyinoluwa Adelowo, Alabama A&M University .

The garbage patch consists of suspended debris, predominantly plastics, which has the potential to cause significant environmental consequences and impact marine life. Five well-known garbage patches exist worldwide, with one of the most notable examples being the Great Pacific Garbage Patch, located in the North Pacific Ocean. Understanding the formation of these garbage patches is critical for addressing marine pollution and developing mitigation strategies. In this project, we aim to analyze drifter data using the well-known Dynamic Mode Decomposition (DMD) technique. Our goal is to determine whether the reconstructed data, using a few dominant DMD modes, can accurately identify the location of the drifters (longitudes and latitudes) as well as their northward and eastward velocities.

The research utilizes satellite-tracked drifter datasets sourced from NOAA's Global Drifter Program. Key parameters such as eastward and northward velocities, and positional coordinates (longitude and latitude) were processed. Singular Value Decomposition (SVD) was utilized to extract dominant modes. Findings revealed the presence of dominant dynamical patterns within the garbage patches. The analysis provided insights into the various drifter patterns. We evaluated the accuracy of the reconstructed data against the original dataset. Reconstruction errors indicated limitations in DMD's accuracy for modeling the drifter’s patterns.

While DMD highlights critical dynamics within garbage patches, further optimization or alternative modeling methods are necessary for enhanced accuracy. Future research will explore the Randomized DMD approach to improve the representation of the drifter movement.

X. BIOETHICS, HISTORY, PHILOSOPHY OF SCIENCE

A Poster Presentation

**Ethical Issues Surrounding Digital Health Technologies.** Shuntele Burns, Alabama State University .

The use of digital health technologies to gather, store, analyze, and interpret massive amounts of health information can help increase the efficiency of healthcare services, improve patient care, and facilitate medical research. However, health data digitization has also given rise to serious ethical issues that require thoughtful consideration and action. A critical issue involves maintaining data security and privacy. Cyberattacks, targeting weaknesses in digital systems, can provide access to patient information; these breaches undermine patient confidentiality and could interfere with patient care. Moreover, off-site services such as cloud storage increase the potential for unauthorized access to patient data. Transmitting information between different systems while preserving security and confidentiality can also be challenging. Another ethical issue relates to the involvement of patients in their health data management. How much control should patients have over their health information? Should they be able not only to access their health data but also to modify their data? What other patient rights should be taken into account? What steps can be taken to help ensure the ethical use of health data? Unequal access to digital health information is also an important ethical issue that needs to be addressed, as inequalities in access to digital data can only aggravate already existing health inequities. These and other ethical issues need to be considered as we continue to explore the advantages and challenges of digital health technologies.