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ALABAMA JUNIOR ACADEMY OF SCIENCE
GORGAS SCHOLARSHIP COMPETITION

March 18-20, 2020



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TABLE OF CONTENTS

SECTION I.	Biological Sciences.....	1
SECTION II.	Chemistry.....	20
SECTION III.	Physics and Mathematics.....	22
SECTION IV.	Engineering and Computer Science.....	31
SECTION V.	Social Sciences	35
SECTION VI.	Anthropology.....	42
SECTION VII.	STEM Education	43
SECTION VIII.	Environmental and Earth Science.....	50
SECTION IX.	Health Sciences.....	52
SECTION X.	Bioethics & History & Philosophy of Science	58
GORGAS	Gorgas Scholarship Competition.....	69

**Numbering of all paper and poster presentations is consistent with that found in the
AAS/AJAS Program Book**

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and students from her Professional Editing class (ENGL 361) for reviewing
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Cover photo by journal editor, Brian Toone, while cycling by the host institution prior to the cancellation of the meeting due to COVID-19. The blurry photo was enhanced using the dry brush effect in a popular photo editing software application.

SECTION I – BIOLOGICAL SCIENCES
Paper Session I
Thursday Morning, 8:30 am – 11:30 am
Arthur J. Bond Hall Engineering Building – Room 136
Brad Bennett, Presiding

1. 8:30 ****g INDIVIDUAL AND TEMPORAL VARIATION OF WINTERING WHOOPING CRANES AT WHEELER NATIONAL WILDLIFE REDUFE, ALABAMA.** *Andrew Cantrell, Yong Wang, Alabama A&M University.*

Since the establishment of the whooping crane (*Grus americana*) eastern migratory population in 2001, more individual birds have been observed overwintering in novel areas across the eastern U.S. Having a novel population that utilizes novel areas coupled with limited knowledge of this population's overwintering ecology increases the need for understanding the mechanisms that influence habitat selection, use, and other behaviors. We examined the individual and temporal variation in whooping cranes during the wintering seasons of 2014-15 and 2015-16 at Wheeler National Wildlife Refuge in Alabama, a site that has experienced increased occupancy over the years. Using linear mixed models, we explored differences in occupancy times, habitats used, and co-occurrence with con- and heterospecifics while including individual life history information (e.g. breeding status, release method) and wetland availability. Individuals differed in their occupancy in wetlands ($p = 0.003$) and refuge crop shares (corn left unharvested; $p = 0.002$). Warmer temperatures and increased rainfall decreased wetland availability in 2015 ($p < 0.000$), contributing to temporal variations detected: shorter duration of stay ($p = 0.007$), and decreased wetland use ($p < 0.000$). Shared use with con- and heterospecifics was higher with non-mated individuals ($p = 0.004$ and $p = 0.002$, respectively), with whooping crane flock size increasing over the wintering season ($p < 0.000$), suggesting that social attraction could influence habitat selection. Due to variations observed, multiple management strategies would be needed for effective conservation, especially when considering how fluctuating conditions influence habitat availability and the use thereof.

2. 8:50 ****g DETERMINING MERCURY CONCENTRATIONS IN TURTLES WHILE IDENTIFYING AREAS OF CONCERN AT WHEELER NATIONAL WILDLIFE REFUGE, ALABAMA.** *Andrew Cantrell, Yong Wang, and Irenus Tazisong, Alabama A&M University.*

Turtles have been found to be good aquatic ecotoxicology study organisms because many species have large distribution ranges and have high longevity. The Wheeler National Wildlife Refuge (WNWR), located in north Alabama, has historical and current toxicology concerns due to nearby industrial activities and the refuge's shared boundaries with a superfund site. From 2014-16, we captured turtles to evaluate differences in mercury (Hg) concentrations across species and differences within species due to age, size, and presence of parasites. We also sought and to identify areas where turtles exhibited elevated Hg concentrations. Claw clippings were obtained from captured individuals and were analyzed using a Direct Mercury Analyzer. We found that out of nine species sampled *Apalone s. spinifera* and

Chelydra serpentina had the highest levels of Hg; however, only *Trachemys scripta* had large enough sample size for other analyses. We found that adult *T. scripta* showed higher concentrations of Hg than juveniles did ($p = 0.006$), females had higher concentrations than males had ($p < 0.001$), and individuals with parasites contained higher concentrations than those without parasites had ($p = 0.005$). Lastly, higher levels of methylmercury (MeHg) were found in turtles from two different areas showing levels of 0.58 mg/kg and 0.33 mg/kg within turtles ($p < 0.000$), warranting further investigation to determine if local contamination sources are contributing to the amount of MeHg within the respective turtles. Our study shows that turtles can be very good organisms to study ecotoxicology, with *T. scripta* being an optimal species for much of the habitat found in the southeast US due to their abundance in multiple wetland types.

3. 9:10 ****g NOCICEPTION, STRESS, AND TEMPERATURE PREFERENCE IN THE ZEBRAFISH (DANIO RERIO).** *Chris Taylor*, Stephen Watts, University of Alabama at Birmingham.

Zebrafish were tested as a suitable model for thermal hyperalgesia, wherein pain sensitivity is increased by noxious temperatures. Adult zebrafish were exposed either to alarm pheromone, system water, or injected in the lips with DDH₂O or acetic acid, followed by swimming in a (61 × 23 × 8 cm) trough with a thermal gradient ranging from 24-35°C. In all cases zebrafish spent the most time in the warmest zone of the tank. In response to a suggestion that the temperature gradient apparatus itself was a stressor, we measured whole body cortisol levels in fish that were acclimated to aquaria at different temperatures. Fish were injected in the lips with acetic acid or DDH₂O and allowed to acclimate in water that was 24°C or 34°C for fifteen minutes. Swimming behavior was recorded for the following fifteen minutes and fish were subsequently euthanized to be tested for levels of whole-body cortisol. No differences in swimming behavior were noted for any of the treatments. This finding contrasts with previous work wherein nociceptive responses at 28°C decreased mobility. Male zebrafish had slightly lower whole-body cortisol at 34°C than 24°C ($p = 0.084$). We hypothesize that warmer environments may decrease the stress response in zebrafish; however, our data suggest that adult zebrafish have limited suitability as a model for thermal hyperalgesia.

4. 9:30 ****u PRELIMINARY MEASUREMENTS OF ESTROGEN LEVELS DETECTED IN NORTHEAST ALABAMA WATERWAYS USING ELISA WITH IMAGEJ REDPLATE PLUGIN ANALYSIS.** *Ansley Winter*, James Rayburn, Jacksonville State University.

Synthetic Estrogen (EE₂) is often found in waterway environments due to human waste or pharmaceutical disposal. An ELISA detection kit with an ImageJ Plugin was purchased for detection of EE₂ in the environment. ImageJ contains multiple plugins for processing and analyses. The particular plugin for this test is called ReadPlate. ReadPlate measures the absorbance of an image of a multi-well plate up to ninety six wells. ImageJ ReadPlate was used to read 96 well plates. This test is intended to detect how much EE₂ is in waterways of northeast Alabama. The water tested was from Germania Springs, Lake Heflin, Hane's Branch Creek, Cane Creek, and Weaver's Creek. A 100 mL bottle of water was collected above and below the water treatment plants at each location. Germania Springs is a natural underground

spring and is being used as the control. To test the accuracy of the ImageJ Plugin for absorbances comparisons with a spectrophotometer were made using methylene blue and a Bradford protein analysis kit. The plate was placed in a light box and a picture of the plate was taken and analyzed using ImageJ. The data from ImageJ using the red channel was more consistent with the absorbances from the spectrophotometer than were the other channels on ImageJ.

5. 9:50 CULTURE CONDITIONS FOR PRODUCTION OF TRICHODERMA SG2 BIOMASS-HYDROLYZING ENZYMES FOR BIOMASS SACCHARIFICATION. *Benedict Okeke*, Auburn University in Montgomery; Ananda Nanjundaswamy, Auburn University at Montgomery and Alcorn State University.

Fossil fuels are non-renewable and cause environmental pollution. Lignocellulose biomass is the most plentiful renewable natural resource and is composed primarily of cellulose, hemicelluloses, and lignin. Using microbial catalysts and fermentation, lignocellulose biomass can be converted to biofuels and chemicals. Complete mixtures of cellulases and xylanases are required for efficient bioconversion of biomass. *Trichoderma* species SG2 produce a complete mixture of cellulolytic and xylanolytic enzymes for biomass conversion. *Trichoderma* SG2 produces more β -glucosidase than *Trichoderma* species RUT-C30 employed in industrial production of cellulase and coproduces amylase with cellulases and xylanases in lignocellulose medium. This study presents factors affecting enzyme production and lignocellulose biomass saccharification by *Trichoderma* sp. SG2. Cellulase and xylanase activities were much higher in solid substrate cultures than in liquid culture. Results indicate potential application of *Trichoderma* SG2 cellulolytic and xylanolytic enzymes in biomass conversion to saccharides for production of biofuels and chemicals.

6. 10:30 DIET, ANXIETY, AND GI QUALITY OF LIFE: IS THERE A LINK? *Mickie Powell*, Bijal Vashi, Rosianna Gray, Alan Whitehead, Chris Graham, Amandiy Liwo, Stephen Watts, and Gregory Kennedy, University of Alabama at Birmingham.

College life can be stressful, especially for freshman students living away from home for the first time. Students are often making food choices on their own, and many of the fast and convenience foods they consume are high in calories, fat, sugar, and salt. Studies have shown that under stress students gravitate to foods high in sugar, salt, and caffeine. As college instructors, we have observed an increase in self-reported student anxiety due to stress and gastrointestinal (GI) issues. Could the combination of stress and poor diet in college students manifest itself in the form of gastrointestinal issues? To better understand how diets, perceived student stress, and/or depression are impacting student GI health we have developed a survey for students in our introductory biology labs. This survey is designed to measure lifestyle factors such diet, stress, anxiety, and depression that may contribute to GI quality of life. Initial data from this survey suggests that students consuming chips, snacks, and sweets have an increase in bowel pain that negatively impacts their daily activities. This same trend was also observed in students who reported experiencing increased mental distress and anxiety. Students with gastrointestinal pain scored lower on the GI quality of life index. The results

of this initial survey suggest that diet and stress may be important targets for intervention to help students improve their GI quality of life.

7. 10:50 ****u IDENTIFICATION AND EXPRESSION OF NAD⁺ SYNTHESIS SALVAGE PATHWAY ENZYMES IN *LACTOBACILLUS*. Silvia Kinnebrew, Bryce Pierce, and Brad Bennett, Samford University.**

Vitamin B3 compounds can be converted into nicotinamide adenine dinucleotide (NAD⁺) and utilized in many metabolic processes. This project aims to identify, study, and compare enzymes within the NAD⁺ synthesis salvage pathway in probiotic species such as *Lactobacillus*. These microbes are critically important in the food fermentation industry. Using bioinformatics, four *Lactobacillus* species with known salvage pathway genes were found: *pncA*, *pncB*, *nadD*, and *nadE*. Although these enzymes have been characterized in several microbial species, there are many outstanding questions to their structure and function in *Lactobacillus*. For example, the substrate preference and oligomerization of the NAD synthetase (*nadE*) enzyme in any *Lactobacillus* species are still unknown. *nadD* and *nadE* genes from three of the *Lactobacillus* species were amplified by PCR, cloned into expression vector, and confirmed by DNA sequencing. To test for expression, the protein product of the *nadD* (*NaAD* synthetase) and *nadE* (NAD synthetase) genes from *Lactobacillus plantarum* were expressed in *E. coli* and the enzymes purified. These will be used for activity assays and structural characterization.

8. 11:10 ****g IMPLEMENTATION OF DRONE-BASED TECHNOLOGY FOR SURVEYING SALTMARSH HABITAT FOR THE DIAMONDBACK TERRAPIN. Nicole Conner, Thane Wibbels, Ken Marion, and Catherine Sirgo, University of Alabama at Birmingham.**

The diamondback terrapin (*Malaclemys terrapin*) is a medium-sized turtle found in estuaries on the Atlantic and Gulf Coasts of the United States. This once abundant species has an integral role in the saltmarsh ecosystem, but the Alabama population is currently considered by the Alabama Department of Conservation and Natural Resources to be of highest conservational concern. Diamondback terrapins have faced, and still face, many anthropogenic threats including reduction of saltmarsh habitat, drowning in fishing gear, hunting or commercial harvest, mortality by motorized vehicles, and nest depredation. Effective management of this species relies on accurate survey methods for documenting location and abundance in Alabama saltmarshes. In this study, we evaluated drone-based technology as a potential methodology. A DJI Phantom 3 Pro drone with 4K video capabilities was evaluated for surveying in the main tidal channel of Cedar Point Marsh (CPM) at the Mississippi Sound in Alabama. Flights were conducted using the Litchi Fly app, allowing us to generate standardized preprogrammed flight plans based on Google Maps. Surveys were flown at an altitude of ~15m and followed the tidal channel for ~2km for a total flight time of approximately twelve minutes. Periodic flights were flown over several nesting seasons, and this drone-based methodology proved to be a reliable system for standardizing surveys documenting both terrapins and birds in tidal channels. In 2020 we are conducting surveys every two weeks to document the occurrence and location of terrapins in the tidal channels at CPM before, during, and after nesting season.

9. 11:30 **g A NEW EUCRYPTODIRAN TURTLE (*TESTUDINES, MACROBAENIDAE*) FROM THE CAMPANIAN OF ALABAMA. *Andrew Gentry*, University of Alabama at Birmingham; *James Parham*, University of California at Fullerton.

A nearly complete turtle shell from the Campanian Mooreville Chalk of Alabama represents a new genus and species of Eucryptodire. *Bingemys tounotos* gen. et sp. nov. is referred to as *Macrobaenidae* based on its large size, lack of carapacial fontanelles, hexagonal neurals II-VII, and the proximal position of the sulcus between vertebral V and marginal XII. *B. tounotos* shares similarities with the coeval taxon *Judithemys sukhanovi*, such as a pronounced ridge on the visceral surface of the first costal, C-shaped bridge peripherals with only superficial insertion points for the thoracic ribs, a nearly rectangular eighth neural, and a lack of plastral fontanelles. *B. tounotos* can be distinguished from other species of *Macrobaenid* by the presence of a proportionally diminutive first costal and nine pairs of costals. *B. tounotos* is the first *Macrobaenid* described from southern Appalachia and only the second Eucryptodiran turtle described from the eastern United States. The occurrence of Eucryptodiran turtles on the eastern edge of Laramidia (*J. sukhanovi*), the southwestern edge of Appalachia (*B. tounotos*), and the northeastern edge of Appalachia (*Osteopygis emarginatus*) indicates that by the Campanian, Eucryptodires were widely distributed across present-day North America. Despite their widespread presence, fossil occurrence data indicate that individual species of *Macrobaenid* may have been regionally endemic. The discovery of *B. tounotos* in the Mooreville Chalk of Alabama illustrates the potential for new taxa even in purportedly well-known faunal assemblages.

**u or **g Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION I – BIOLOGICAL SCIENCES
Paper Session II
Thursday Afternoon, 1:00 pm – 3:00 pm
Arthur J. Bond Hall Engineering Building – Room 136
Mary Anne Garner, Presiding

10. 1:00 ****u** THE PURSUIT OF LITTLE-KNOWN BIODIVERSITY: A SURVEY OF BRYOPHILOUS FUNGI IN AN ALABAMA WOODLOT. Brenn Schmittou, University of North Alabama; *Peter Döbbeler*, Ludwig Maximilian University of Munich; Paul Davison, University of North Alabama.

Bryophilous ascomycetes are fungi that form tiny fruit bodies upon bryophytes and live as biotrophic or necrotrophic parasites upon their hosts (mosses and liverworts). These organisms are rarely, if ever, included in biodiversity studies. The goal of this study was to demonstrate the surprising abundance and diversity of these little-known organisms occurring in a 1.5-hectare woodlot in northwest Alabama. We focused primarily on *Bryophilous ascomycetes* parasitizing the liverwort, *Frullania*. Six species of *Frullania* occurred in the study site: *Frullania appalachiana*, *F. eboracensis*, *F. ericoides*, *F. inflata*, *F. kunzei*, and *F. virginica*. Of these, only two species (*F. inflata* and *F. virginica*) were locally abundant and were the only liverworts found to harbor *Bryophilous ascomycetes*. We observed known and unknown *ascomycetes*, which included *Bryonectria callicarpa* on both *F. inflata* and *F. virginica*, *Periantria frullaniae* on *F. virginica*, *Bryocentria lusor* on both *F. inflata* and *F. virginica*, and *Hypobryon bacillare* on *F. inflata*. The latter two species were recently named new to science, and the two former species were recently reported new for North America. Other fungi of uncertain taxonomic placement were also found fruiting upon bryophytes. Our documentation of these species in a small area indicates that the abundance of *Bryophilous fungi* is underappreciated. It is likely that many species of *Bryophilous fungi*, that are in fact common, are unknown to science.

11. 1:20 ****u** VARIED ENRICHMENT FOR AFRICAN LIONS (*Panthera leo*) AND CHEETAHS (*Acinonyx jubatus*). *Amanda Beddingfield*, Faulkner University.

This research project explored the idea of how enrichment can help to improve the overall well-being of animals in a captive environment and how this knowledge can help with the conservation and education of different species of animals. In order to improve the enrichment programs, empirical validation needed to be explored and associated with the enrichment techniques. There are many different types of enrichment, and they were given on a specific schedule or randomized. With many experiments, the focus was one type. Sometimes, the schedule was specific, but other times, it was randomized. This specific project combined different types of enrichment. It included a schedule that was somewhat specific and randomized to see if a combination was the best technique for enrichment programs. This study focused on two of the felids, lions and cheetahs, specifically at The Montgomery Zoo. It used scent, food, object, problem-solving, and associated-learning enrichment techniques. The study lasted for eighteen weeks with observations being made about the animals' behaviors. These scans represented the statistical data of the experiment which showed that varied enrichment decreased stereotypical

behavior and improve the overall well-being of the animals. This result informs educational and conservation efforts.

12. 1:50

****g IMMUNOHISTOCHEMICAL ASSESSMENT OF THE MECHANISMS BY WHICH CHEMICAL DISPERSANT (Corexit 9500A) AFFECTS THE STRUCTURE AND ION TRANSPORT FUNCTION OF BLUE CRAB (*Callinectes sapidus*) GILLS.** Amanda Weiner, Joseph W. Palmer, and R. Douglas Watson, University of Alabama at Birmingham.

Chemical dispersants are commonly used in remediation of spilled oil. For example, an estimated 2.1 million gallons of chemical dispersant, mainly Corexit 9500A, were applied in remediation efforts following the sinking of the Deepwater Horizon offshore drilling platform in the Gulf of Mexico in 2010. Our previous data showed that exposure of blue crabs (*Callinectes sapidus*) to Corexit 9500A negatively impacts both the structure and ion transport function of gills. Based on preliminary data, we hypothesize that Corexit 9500A induces NADPH oxidase (NOX)- and C-reactive protein (CRP)-mediated production of reactive oxygen species (ROS) in gill tissue, leading to caspase 3-dependent apoptosis. In studies reported here, we used immunohistochemical methods to assess NOX4, CRP, and cleaved caspase-3 in gills from control and Corexit 9500A-exposed *C. sapidus*. The results showed that exposure to Corexit 9500A (60-125ppm) produced an increase in NOX4-, CRP-, and cleaved caspase-3-immunoreactivity in gill tissue. The findings are consistent with the notion that exposure of blue crabs to Corexit 9500A triggers NOX- and CRP-mediated production of ROS leading to apoptosis that compromises the structural integrity and ion transport function of gills. [Research supported by the BP/Gulf of Mexico Research Initiative.]

13. 2:10

THE RETT-SYNDROME *MECP2* ALLELE IN MICE DOES NOT APPEAR TO INCREASE THE NUCLEAR OR MITOCHONDRIAL GENE MUTATION RATE. Mary-Catherine Mitchell, Hannah Olive, Katherine Wilson, Coleman Reeves, and David Johnson, Samford University.

Rett Syndrome is a human neurological disease caused by the mutant X-linked *MECP2* allele and resulting in physical and mental limitations. The wild-type allele produces a repressor which dampens transcription by binding to methylated DNA. Rett individuals lack this transcriptional dampening, with the brain being most affected. Rett-syndrome-model mice carry the mutant *MECP2* gene. We have undertaken an extensive study to test whether some of the effects of Rett might be caused by secondary mutations in *MECP2*-mutation-carrying individuals. Affected mice show progressive age-related deterioration in motor function. Although Rett-syndrome humans do not show pronounced later-age deterioration, there is definite progressive development of symptoms in early life, usually attributed to unregulated transcription. We were interested in determining if any of the developmental abnormalities might be attributed to the accumulation of secondary mutations in the presence of the mutant *MECP2* allele. We asked two questions: Has the mouse strain carrying the *MECP2* mutation accumulated more mutations since its creation than the strain from which it was created and do nuclear or mitochondrial mutations accumulate in circulating or brain cells of older *MECP2* mice at a higher rate than in older wild-type mice? To test for mitochondrial mutations, we sequenced the D-loop region of mitochondrial DNA, and for nuclear mutations, we used a ribosomal

RNA internal transcribed spacer sequence. Our sequence data shows no evidence in either study of significant increases in mutations in mutant-*MECP2*-bearing mice.

14. 2:30

SPACE USE AND ROOST-SITE SELECTION BY MALE CERULEAN IN ALABAMA DURING THE BREEDING SEASON. *Yong Wang*, Alabama A&M University; *John Carpenter*, Alabama A&M University; *Callie Schweitzer*, Southern Research Station, USDA Forest Service.

Detailed information about space use during the breeding season is limited for most Nearctic-Neotropical migratory species of songbirds because of their small size and often cryptic behaviors. We monitored male Cerulean Warblers (*Setophaga cerulea*), a species of conservation concern, using radio telemetry in northern Alabama to better understand their space use and habitat selection. We estimated diurnal home range and core areas using information theoretic criteria. We also located nocturnal roost sites, and related day and evening locations to surrounding landscape habitat, including features representative of canopy disturbances. Mean home range size was 6.7 ha (N = 10), and home ranges included an average of two core areas encompassing 0.7 ha. We located fifty-three nocturnal roost sites that were an average 159 meters from the center of the nearest core area. More than one-third (36.6%) of roost sites were located outside the diurnal home ranges; only 13.6% were located in core areas. Male birds in our study moved much farther than reported in previous studies, with some singing in areas greater than 300 meters from previously used song perches. This behavior may suggest pursuit of extra-pair copulations. Cerulean Warblers in our study preferentially selected a heavily forested landscape composed of mesic, floodplain bottomlands with little man-made disturbance. Within their home ranges, diurnal locations in core areas were located significantly closer to a creek than locations outside of core areas. Our results suggest that male Cerulean Warblers require much larger areas than previously reported and underscore the importance of a predominately forested landscape in their habitat selection process. Although edge habitats appeared to influence space use by male Cerulean Warblers in our study, the extent to which this is an essential requirement is unclear. Our results, and those of previous studies, suggest that specific habitat requirements of this species can vary at the local scale throughout its breeding range.

15. 2:50

**g ABIOTIC FACTORS THAT INFLUENCE CAVE USE BY SALAMANDERS. *Joseph Lamb*, *Andrew Cantrell*, and *Yong Wang*, Alabama A&M University; *Matthew Niemiller*, University of Alabama Huntsville.

Lungless salamanders (family *Plethodontidae*) rely on cutaneous and buccopharyngeal gas exchange, which strongly influences temperature and moisture regimes that can be inhabited. While many *plethodontid* salamanders have been documented to use caves for at least part of their life cycles, few studies have examined the factors that affect the abundance and diversity of salamanders in caves. No such studies have been conducted on salamander communities in caves of northern Alabama. This study aims to determine a relationship between salamander diversity and abundance among northeastern Alabama caves and environmental variables. Surveys are being conducted in fifteen caves every season from July 2018 through June 2020, documenting salamanders along transects from entrance to found within the first 160 meters into the dark zone. Environmental variables, such

as air temperature, humidity, and wind speed, are being characterized along study transects, and climatological and landscape data around cave locations, such as rainfall, surface temperature, slope, and land cover, are being recorded to determine relationships between these variables and salamanders' diversity and abundance among seasons. We will be presenting the preliminary data on the use of caves by salamanders, displaying seasonal preference, species abundance, and spatial preferences.

SECTION I – BIOLOGICAL SCIENCES
SECTION VIII – ENVIRONMENTAL AND EARTH SCIENCES
Concurrent Poster Session
Thursday Afternoon
Arthur J. Bond Hall Engineering Building – Auditorium

Authors Set-up: Begins at 12:00 pm
Authors Present: 3:00 pm– 5:00 pm
Brad Bennett, Presiding (Biological Sciences)
Malia Fincher, Presiding (Environmental and Earth Sciences)

SECTION I – BIOLOGICAL SCIENCES
Posters

16. **g GROWTH AND PRODUCTIVITY OF LOBLOLLY PINE IN RESPONSE TO BARK BEETLE ASSOCIATED FUNGI. *John Mensah*, Auburn University; *Mary Sword Sayer*, USDA Forest Service, Southern Research Station, Pineville, LA.; *Ryan Nadel*, Auburn University; *George Matusick*, New York City Department of Environmental Protection, Bureau of Water Supply, Natural Resources Division.; *Zhaofei Fan*, Auburn University; *Lori Eckhardt*, Auburn University.

Loblolly pine (*Pinus taeda L.*) is a predominant and economically important timber species in the southeastern United States, but it suffers from growth decline and mortality. Root-feeding bark beetles and their associated *ophiostomatoid* fungi (OPF) have been hypothesized to contribute to loblolly pine decline. Nonetheless, the role of the fungi in southern pine decline remains unresolved. We evaluated varying inoculum density of *Leptographium terebrantis* on thirteen-year-old loblolly pine growth and productivity at Eufaula, Alabama. Artificial inoculations were done using sterilized and *L. terebrantis* colonized toothpicks to simulate the natural feeding habits of bark beetles. Thirty-three months post-inoculation treatment, the high inoculum and control treatment caused 50% and 19% reduction in relative basal area increment respectively; growth decline resulted in a 30% mortality among the high inoculum trees. The results demonstrate that the OPF, *L. terebrantis*, contributes to loblolly pine decline and mortality at high inoculum density.

17. **g COMPARATIVE TRANSCRIPTOME AND EPIGENOME ANALYSES OF SALT-TOLERANT AND SALT-SUSCEPTIBLE GENOTYPES OF SOYBEAN. *LaMont Croom*, *Zachary Gossett*, *Govind Sharma*, and *Venkateswara Sripathi*, Alabama A&M University.

Salinity stress is a known abiotic constraint that impedes the vegetative growth, yield, and quality of crop plants. Soybean (*Glycine max*) as a commercially important staple crop

which serves as food, feed, and fuel, commercial production, and health is vital to the growing populations of the global community. This is the first genome-wide DNA transcription profiling study in salt-sensitive (Dare) and salt-tolerant (Lee-68) genotypes of soybean using RNA-Sequencing (RNA-Seq) approach. This study includes two genotypes (Dare and Lee-68); three NaCl treatments (0 mM, 75 mM, and 150 mM); three collection time points (0 Days After Treatment (DAT); 7 DAT; and 14 DAT) with three replications (R1, R2, R3), which is equivalent to fifty-four [2x3x3x3] samples each for isolating DNA and RNA. Later, RNA Sequencing and Whole Genome Bisulfite Sequencing (WGBS or BS-Seq) libraries were prepared and sequenced on NextSeq 550 (Illumina), with an estimated yield of ~900 million reads. Quality reads were pre-processed (trimming and filtering), mapped to the reference genome, assembled, and annotated to identify differentially expressed genes (DEGs) and differentially methylated regions (DMRs). Using bioinformatics analysis on our experimental permutations in soybean, the comparative transcriptome analyses identified over 1,000 DEGs and ~100 DMRs that were significantly expressed in the salt-tolerant and salt-susceptible genotypes of soybean. In conclusion, the comparative unstressed and salt-stressed gene expression analysis of Lee-68 and Dare soybean genotypes will aid in identifying critical genes and pathways involved in combating the harmful physiological effects associated with salinity stress.

18. **g TRANSCRIPTOME ANALYSES OF FOUR *GOSSYPIMUM* SPECIES USING RNA SEQUENCING. *Shalini Priya Etukuri*, Zachary B. Gossett, Manish Jakka, Govind C. Sharma, Venkateswara R. Sripathi, Alabama A&M University.

Cotton is valued as the world's leading natural textile fiber and a prominent oilseed crop. The cotton genus *Gossypium* consists of 45 diploid and six tetraploid species. Although it contains more than 50 species, only four species produce spinnable fiber, of which two are considered as diploid ($2n=26$) and two are tetraploids ($2n=52$). Among them, upland cotton (*Gossypium hirsutum* [AADD]) is the most widely cultivated cotton species. It has likely evolved from two wild ancestral genomes A&D: the A genome donor being *G. herbaceum* (A1) or *G. arboreum* (A2), and the D genome contributor being *G. raimondii* (D5). In this study, transcriptome analyses of four *Gossypium* species (*G. hirsutum* cv. TM-1, *G. herbaceum*, A1-141, *G. arboreum*, A2-44, and *G. raimondii*, D5-24) were conducted from seed and root tissues by using RNA sequencing. Delinted cotton seeds were ground in liquid nitrogen and total RNA was isolated. Then RNA was quality-tested and used for sequencing and bioinformatics analyses. The transcriptome analysis of four species identified over twenty thousand differentially expressed genes (DEGs) when compared to the control plants. Among these, ten significant DEGs ($\text{Log}_2\text{FC}>2$) with a prominent role in biotic and abiotic stresses, about 50 transcription factors with a possible role in gene regulation and cellular processes, and ten genes associated with R-proteins were identified. Additional work is required to validate the predicted DEGs related to biotic/abiotic stress tolerance.

19. **u THE EFFECTS OF SALINITY STRESS ON SENSITIVE AND SALT-TOLERANT GENOTYPES OF SOYBEAN *Kindrea Gibbons*, LaMont Croom, Govind C. Sharma, Venkateswara R. Sripathi, Alabama A&M University.

Salinity stress is a known abiotic constraint that decreases the vegetative growth, yield, and quality of crop plants. *Glycine max*'s (soybean) commercial production and health is central to sustaining the increase of the global community due to its multifaceted use as food, feed, and fuel. This is the first phenotypic profiling study in salt-sensitive (Union) and salt-tolerant (S-100) genotypes of soybean for downstream next-generation sequencing (NGS) applications.

This study included two genotypes (Union and S-100); three NaCl treatments (0 mM, 75 mM, and 150 mM); three collection time points (0 days after treatment, 7 DAT; 14 DAT; and 21 DAT) with three replicates (R1, R2, R3), or 54 [2x3x3x3] biological independent samples. Biomass, leaf scorch score (LSS: 1-9; 1 = no chlorosis; 9 = necrosis), and DNA and RNA quality (A260/230 ranged between 1.8-2.1) were assessed under greenhouse conditions on salt-sensitive and salt-tolerant genotypes of soybean to characterize the salt-tolerant phenotype in soybean. The increase in salinity concentrations led to a rise in LSS and resulted in a decrease in biomass, RNA, and DNA quality. A non-saline (control) and two saline (75 mM and 150 mM NaCl) conditions were used to monitor change in morphology and biomolecule quality and quantity. A single leaf was procured at 0 DAT, 3 DAT, and 7 DAT from the most mature trifoliolate, from each biological replicate, to assess phenotypic, quantitative, and qualitative aspects of the tissue. Preliminary results show that Union, the salt-sensitive cultivar, has a more observable change in leaf color and reduction in biomass when compared to the salt-tolerant, S-100. The complete set of results are in progress and will be reported at the time of the conference. However, it is key to note implications from this study could confirm the degree of tolerance and or susceptibility of salinity stress in two contrasting cultivars of soybean. The morphological and physiological data generated can augment the downstream NGS applications.

20. **u THE LESSER OF TWO WEEVILS: WEEVIL INFESTED WHITE OAK ACORNS HAVE A HIGHER MICROBIAL RICHNESS. *Hannah Harper*, Abigail Collins, Frank Gonzalez, Malia Fincher, Samford University.

White oak (*Quercus alba*) acorns are susceptible to pre-dispersal seed predation by acorn weevils (*Curculio spp.*), which often consume much of the cotyledons, decreasing germination and seedling success. Adult female weevils chew a small hole in the acorn, oviposit, and then seal the oviposition site with feces. The eggs hatch and the juvenile weevils complete their larval development inside of the acorn. After chewing a small exit hole through the fruit wall, the weevil pupates over the winter in the leaf litter. Both oviposition and the larval exit hole present opportunities for microbes to enter the acorn. Vertebrates, including rodents, deer, and birds, also consume acorns, resulting in damage that may be associated with microbial growth in the acorns as well. We hypothesized that weevil infestation and vertebrate attack would increase internal microbial species richness in *Quercus alba* acorns in Oak Mountain State Park. Acorns were externally sterilized and cut in half. Inner cotyledon was inoculated on nutrient agar plates with a sterile loop and incubated at 25-30 °C. The microbial colonies were pure inoculated and incubated at 25-30 °C. Microbial morphospecies were described based on morphological characteristics. Weevil infested acorns had a higher number of microbial morphospecies compared to uninfested acorns. This research raises questions about whether weevils intentionally deposit beneficial microbes when they oviposit in developing acorns.

21. **u THE K(3) HERBICIDE ALLIDOCHLOR CAN CAUSE VARIATIONS IN THE BIOSYNTHESIS OF ALKENONES IN *EMILIANA HUXLEYI* STRAIN 1516. *Frank Gonzalez*, Samford University; Betsy Read, California State University of San Marcos.

Emiliana huxleyi, also known as *E. hux*, is one of the most abundant phytoplankton on earth and has attracted the attention of biogeochemists, oceanographers, climatologists, and those in the biotech industry. *E. hux* is characterized by its unique calcium carbonate cell covering and is also one of only five species in the world to produce long-chain lipids known as alkenones. These alkenones are exceptional because they have long carbon chain lengths between 36-41, and they have the potential to be used for renewable petroleum products and are already being

used as a paleothermometer. The aim of this research was to characterize neutral lipid profiles from three spontaneous mutants exposed to the long-chain fatty acid elongase inhibitor, allidichlor, which will be used to determine the genetic lesion and its effects on gene expression. We found that the mutants resulting from allidichlor exposure exhibited different neutral lipid profiles compared to the wild type, *Emiliana huxleyi* strain 1516. They also produced fewer alkenones, and the types of alkenone profiles differed to that of the wild type. These results can be used to identify the genetic lesion resulting in different neutral lipid profiles and survivability of the mutants, determine the impact of said lesion on gene expression, and discern whether the wild-type phenotype can be restored upon repairing the genetic lesion.

22. **g A COMPREHENSIVE IDENTIFICATION OF GLUTATHIONE-BINDING PROTEINS IN *ARABIDOPSIS THALIANA*. Anna Moye, Sang Wook Park, Skylar Wilson, Auburn University.

Tripeptide glutathione (GSH) is the most abundant, small thiol molecule in plants, animals, and microbes. Until recently it has been characterized as a nonspecific antioxidant that detoxifies a broad range of toxic peroxides and peroxy nitriles. We, however, have uncovered novel activity of GSH, directly binding and modulating the functional state of redox-sensitive enzymes (e.g., peroxiredoxins), which in turn activates redox signaling cascades in maintaining cell growth and metabolisms. To further understand a mode of GSH-mediated post-translational modification, the present study has attempted the comprehensive identification of *Arabidopsis thaliana* GSH-binding proteins (AtGBPs), utilizing a batch affinity chromatography technique. Total extracts prepared from *A. thaliana* were subjected to a GSH-agarose resin and washed with 50 mM Tris buffer containing 50 mM NaCl (pH 7.5). The column was further washed with 0.1 mM GSSG to remove nonspecifically bound proteins, and column-bound proteins were eluted with 10 mM GSH. Both GSSG and GSH eluates were then fractionated by SDS-PAGE and identified by MS analyses. Thus far, three independent purifications have carried out and identified 66 AtGBP candidates. The next step is to clone these proteins into the *E. coli* expression system for the subsequent validation of their GSH-binding affinity, which will assist us to elucidate more specific functions of GSH in the cellular regulations and mechanisms.

23. **g GLUTATHIONE ACTIVATES AUTONOMOUS REDUCTANT SIGNALING CASCADES INDEPENDENTLY FROM OXIDATIVE STRESS SIGNALING. Pratima Subedi, Sang Wook Park, Auburn University.

Glutathione (GSH; γ -L-glutamyl-L-cysteinyl-glycine) is the most abundant nonprotein thiol in plants, acting as a major reducing agent transmitting oxidative stress signaling. GSH acts as a major antioxidant that prevents damages to a variety of important cellular components. It reduces reactive oxygen species and other peroxides by donating its electron (H^+ , e^-) and is subsequently oxidized to a disulfide form (GSSG). 2-cysteine peroxiredoxins (2CPA) are key proteins possessed by plants that are able to detoxify hydrogen peroxide molecules. Here we demonstrate a unique, regulatory reaction of GSH that operates autonomous metabolic and signaling pathways. Our preparatory pull-down assays showed that *Arabidopsis* 2CPA can directly bind to GSH-agarose beads underpinning the potential S-glutathionylation of 2CP-family proteins. A series of redox mobility assays demonstrated a unique activity of GSH where it oxidizes and directly binds to the sulfhydryl group of cysteine residues, modifying the quaternary structure of 2CPs, which in turn determines and protects their structure-function against enzymatic reductions and various ecological constraints that cause pH flux and/or oxidative stresses. The GSH-binding kinetics of 2CPs is coordinated by systematic regulations

of GSH synthesis and attendant reduction capacity, occurring independently of free radicals and oxidant generations. Thus, we conclude that GSH can also act as a signal activating redox and enzymatic cascades, besides a general antioxidant (electron donor).

24. **g MICROBIAL DIVERSITY ASSOCIATED WITH THE ORAL AND FECAL SAMPLES OF WHITE-NOSE SYNDROME (WNS) INFECTED GRAY BATS AND TRICOLORED BATS. *Kristina Burns, Venkateswara R. Sripathi, William Stone, Jeanette Jones, Leopold Nyochembeng, Govind Sharma, Alabama A&M University.*

White-nose syndrome (WNS) has spread rapidly across the eastern United States and Canada since it was first documented in New York over a decade ago. The causative organism for WNS in bats is *Pseudogymnoascus destructans*, and it has accounted for 5.7 million deaths of bats in the United States. Molecular mechanisms associated with the WNS and the resultant shift in the microbial diversity are underexplored. Species identification was achieved by using both field-based methods and molecular techniques. This study included two bat species (gray, *Myotis grisescens* and tricolored, *Perimyotis subflavus*); one condition (WNS-infected); two populations (males and females); and two sample types (oral and fecal swabs) with six replicates (R1–R6). In total, 48 microbiome samples (2x1x2x2x6) were selected for microbial DNA extraction (ZymoBIOMICS). The DNA isolated from two sample types (oral and fecal) was compared using two different methods (spectrophotometer-based and quantitative PCR) and three different preservation media (ethanol, NaCl-saturated dimethyl sulfoxide-DMSO, and silica desiccant) compared. The results showed that fecal samples and silica yielded more DNA. Microbial diversity was assessed by sequencing single-end libraries of amplified 16S rDNA genes from respective microbiomes and analyzed using QIIME 2. The readings were clustered into operational taxonomic units (OTUs), and phylogenetic trees were constructed with closely related bacterial species to compare microbiomes. Preliminary results indicated that the majority of OTUs identified belonged to the phylum Spirochaetes with *Leptospira* being the dominant genus. Further, with bats being a mammalian system, the knowledge generated here can be applied to humans.

25. **u THE INFLUENCE OF pH ON BACTERIAL COMMUNITY COMPOSITION OF SOILS FROM THE WINFRED THOMAS AGRICULTURAL RESEARCH STATION. *Jayla Pettway, Elica Moss, Alabama A&M University.*

There is considerable variability in the abundance of different phyla in soils; however, it is not clear to what extent variations are in response to conditions in soil environments. Proteobacteria, Acidobacteria, and Actinobacteria are most abundant in soils as Bacteroidetes, Firmicutes, and Planctomycetes are generally less abundant. The factors that may influence the abundance of these bacterial phyla could be large. Research suggests the abundance of Verrucomicrobia is influenced by soil moisture and Acidobacteria by soil pH. The Winfred Thomas Agricultural Research Station at Alabama A&M University contains a variety of agricultural soils used for the growth of industrial hemp, switchgrass, sweetgum, soybean, biochar infused soil and pasture soils. For this study, samples were collected to assess the influence of soil pH on differences in bacterial community composition using metagenomic approaches. DNA was extracted using the ZymoBIOMICS®-96 MagBead DNA Kit and sequenced on Illumina MiSeq™. Results identified the abundance of bacteria phylum, such as Proteobacteria, Actinobacteria, and Acidobacteria, patterns of their distribution within each soil community and the overall diversity among the soils. Biochar soil, the most acidic, pH 4.5, seemed to contribute to the abundance of Actinobacteria (62.78 %) whereas Actinobacteria in Industrial Hemp, pH 7.84, comprised only 27.75 % of the community. Consequently,

Acidobacteria was least abundant (5.7%) in biochar and greater (17.35%) in hemp. Additionally, industrial hemp soil was more diverse than any other soil community. Further research will aid in identifying other factors that may contribute to the variability in soil bacterial community composition.

26. **g UNCOVERING THE DIRT ON NORTH BIRMINGHAM. *Sarah Adkins, Qutia Roberts, Robert Aksycn, Sam Gregory, Kathryn Aler, Alex Dawson, University of Alabama at Birmingham; and Brad Bennett, Samford University.*

Environmental injustice by way of heavy metal pollution from large-scale industry has plagued the north Birmingham 35207 zip code for decades. Former research has shown that residents in the 35207 zip code face almost double the risk of respiratory disease compared to residents in neighboring zip codes like 35214. Considering that bacteria, which confer resistance to heavy metals, can use those same resistance pumps to resist antibiotics, it may also be possible that bacteria in the soil in 35207 has increased levels of antibiotic resistance compared to the 35214 zip code. To test this, we collected six homogenized soil samples from public areas in both zip codes. DNA was subsequently extracted with the Qiagen PowerSoil Kit, analyzed using Illumina MiSeq, and processed using ordination analysis from mothur. With the help of student course-based undergraduate researchers at three Birmingham universities, we found significant effects of metal concentration on the microbial community structure. Now that this has been confirmed, ongoing work will compare these trends to the antibiotic resistance, using culture-based methods and sequencing of plasmids. Local north Birmingham stakeholders, like those from the coalition People Against Neighborhood Industrial Contamination (PANIC), have asked for more direct evidence between the pollution and health problems to which this work makes an important contribution.

27. **u ENVIRONMENTAL IMPACT ASSESSMENT OF PROPERTY TRENDS TO STIMULATE REVITALIZATION IN AFRICATOWN IN MOBILE, ALABAMA, USING ARC GIS. *Sameerah Rice, Elica Moss, Alabama A&M University.*

Vacant and abandoned property is increasingly recognized as a significant barrier to the revitalization of cities. This type of property affects aspects of community life, including housing/neighborhood vitality, crime prevention, and commercial district vitality. Africatown is a historic community three miles north of downtown Mobile, Alabama. It was formed by a group of 32 West Africans brought to the United States on the last known slave ship, the Clotilda. Once home to around 10,000, Africatown's population has decreased to ~3,000. Abandoned houses line the town, and residents consider them a significant problem. With the recent discovery of the Clotilda, the community has an opportunity to leverage international interest in its extremely unique history for economic development and improvement in health and educational benchmarks for their youth. To assess the impact of the discovery on heritage tourism development within the area, the Africatown Housing Assessment Project recognizes the need to collect and analyze available data related to home ownership, rent, condemnation, and tax assessment. The goal of the project was to analyze the past 5 years of available data of 450 homes and apply it to ArcGis, which generated a map of the properties. The trends documented existing and changing home ownership patterns, property tax rates, and housing condemnation and destruction within Africatown. This study serves as the genesis to combat the issue of vacant and abandoned property problem in Africatown that could lead to aggressive code enforcement, tax foreclosure, eminent domain, and cosmetic improvements, thereby stimulating economic development.

28. **g EVALUATING THE ROLE OF INNATE IMMUNE GENE EXPRESSION IN MELANOCYTE BIOLOGY. *Alex Dawson, Melissa Harris, Joseph Palmer, University of Alabama at Birmingham.*

The convergence theory of vitiligo, the most accepted theory of vitiligo pathogenesis, states that vitiligo is the contribution of multiple factors, such as oxidative stress, innate immune dysregulation, and autoantigenicity, which causes T-cell infiltration. However, it is currently unknown if a particular innate immune signature could be predictive of melanocyte fragility that could trigger the onset of vitiligo. In order to test whether gene expression changes in the melanocyte are sufficient to cause melanocyte fragility, we will employ a transgenic mouse line, C57B6/J.Tg(Dct-Sox10). Tg(Dct-Sox10) mice conditionally over-express transcription factor SOX10 in the melanocyte. SOX10 is necessary for melanoblast development, melanocyte stem cell retention, differentiation, and normal pigment production. Tg(Dct-Sox10) mice exhibit elevated sensitivity to viral activation, which is expressed through acute graying in the subsequent hair cycle. RNA-seq performed on skin samples of Tg(Dct-Sox10) mice shows upregulation of innate immune genes related to viral reception compared to WT C57/B6J mice, and we hypothesize that innate immune dysregulation is causing the loss of melanocyte stem cells in the transgenic mice. We will attempt to elucidate the mechanism that causes increased sensitivity to viral reception and melanocyte loss. We will be determining whether the sensitivity to viral reception is due to the transgenic insertion location, gene regulation by SOX10, or due to increased cellular stress from increased pigment production. It is expected that we will see changes in innate immune gene expression following changes to the cellular pigment production, denoting it as the primary factor in causing gene expression changes.

29. **u EFFECTS OF NITROTYROSINE ON DOPAMINERGIC SH-SY5Y CELLS: IMPLICATIONS FOR PARKINSON'S DISEASE. *Allie Smith, Mary Anne Garner, Judson College.*

Parkinson's disease is one of the most common neurodegenerative diseases in the world. The disease is characterized by the death of dopaminergic neurons in the substantia nigra. The death of these neurons can lead to the development of tremors, bradykinesia, and memory disorders. The exact mechanism behind Parkinson's disease is unknown. However, reactive oxygen species and reactive nitrogen species have been implicated in most neurodegenerative diseases, including Parkinson's disease, amyotrophic lateral sclerosis, and Alzheimer's disease. This study utilizes the SH-SY5Y neuroblastoma cell line, which can be differentiated into dopaminergic, neuron-like cells when treated with brain-derived neurotrophic factor and retinoic acid. In this presentation, we describe the effects of 3-nitrotyrosine on cell growth, cell differentiation, and cell death in the SH-SY5Y cell line. Nitrotyrosine is formed as the result of the interaction between reactive oxygen and nitrogen species. It is found in diseased tissues of animal models and human patients suffering with neurodegenerative diseases. These experiments investigate the effects of nitrotyrosine on the cell pathways involved in cell division, cell differentiation, and apoptosis, in an effort to identify points of intervention for potential treatments for these diseases.

30. **g ESTABLISHING THE EFFICACY, ACCURACY, AND REPRODUCIBILITY OF A BRAIN METABOLITE ISOLATION PROTOCOL. *Victoria McConnell, Bernhard Vogler, Sharifa Love-Rutledge, University of Alabama in Huntsville.*

Proton nuclear magnetic resonance metabolomics can provide novel information about changes occurring during disease onset. The first objective of our research is to establish the efficacy,

accuracy, and reproducibility of a brain metabolite isolation protocol in extracting water-soluble metabolites. We will then use it to discover differences in the brains of two aged rat groups with and without glucose intolerance. The initial protocol/equipment was tested by using only known standard solutions of beta-alanine to see how much was recovered for normalization. Filtration caused a 24% loss of beta-alanine, so filtration was eliminated. The improved protocol, also using beta-alanine in solution, was applied to the brains of young rats, aged to 10 weeks on a standard diet. Beta-alanine recovery was lower than expected, but additional pure solvent rinses increased its recovery rate. In addition, we discovered that the premixed beta-alanine degrades over time. To account for loss of the beta-alanine in the standard solution, it is now tested separately in parallel to its addition to brain samples. Double-stranded DNA concentration was measured to use as an internal normalization standard. Total protein concentration was determined with the Lowry method on the remaining tissue pellet for a second internal normalization factor and to show the adequacy of tissue extraction. This protocol can now be applied to aged rat models with and without glucose intolerance. We expect brain metabolites in glucose intolerant rats with elevated serum insulin will establish a unique signature of altered metabolism around the onset of brain insulin resistance.

31. **g TROUBLE WITH THE TIGHT JUNCTION: THE EFFECTS OF TGF- β IN PAH. *Alyssa Pace-Patterson, Jonathan Brown, Caleb Hamilton, Adam Morrow, Audrey Vasauskas, Rebekah Morrow, Alabama College of Osteopathic Medicine.*

Pulmonary arterial hypertension (PAH) is an incurable disease causing premature death. Remodeling the pulmonary arteries increases vascular resistance. The increased resistance is partly due to endothelial to mesenchymal transition (EndMT), which changes endothelial cells (EC) to a muscular, fibroblast-like lining. EC function depends on cell-to-cell junction and cell-to-ECM proteins. We explored EndMT and the specific effects of TGF- β on various EC proteins in PAH. Control cells (FR6) and diseased cells (SPAC and SPAD) were treated with TGF- β or a vehicle for 24 hours. Supernatants and whole cell lysates were collected, RNA was isolated, and western blots and RT-PCR were run. The data shows signs of a cellular transition, including decreases in cell-to-cell adhesion. Our findings suggest cells change in structure with the addition of TGF- β . Cell-to-cell adhesion molecules in the disease state decreased with the addition of TGF- β . This suggests a structural change, which may allow more leakage and a less concentric lining to protect from edema and pathogens. In addition to the potential loss of barrier function, we found a reduction of proteins involved in leukocyte trafficking, which could alter appropriate immune responses, further supporting functional changes in the endothelial cells. The work was supported by 1 R15 HL137135-01A1.

32. **u INTERFACE-ORIENTED BEHAVIORS IN THE COASTAL LOBATE CTENOPHORE *MNEMIOPSIS LEIDYI*. *Angeline Lawson, Anthony Moss, Auburn University.*

Mnemiopsis leidyi, a common coastal lobate ctenophore from the northern Gulf of Mexico, exhibits a complex behavior. We confirmed data from animals in Apalachicola Bay, Florida, (collected in 2004) and extended our ctenophore behavior knowledge base with improved imaging. Animals from Mobile Bay, Alabama, were dipped during July 2019 and transferred to a 15-gallon tank illuminated by LED strip lights (SMD 5050M, Daybetter). 19 adults were followed over 5 days with 1080p images recorded at 5-second intervals (Everio camcorder GZ-M300, JVC). Most behaviors involved interactions with interfaces. Interface behaviors included: a) Looping -- transient backward swimming with geotaxis change; b) Pulsing -- listlobe clap and return to substrate; c) Skipping -- repeated #2 w/lateral displacement; d) Stationary -- straightened auricular lobes and oral lobes contacting substrate; e) Hovering-- 1)

horizontal, 2) mouth down, and 3) mouth up; f) Rolling – midwater rotation around any axis or across axes (yawing); g) Spiraling – helical swimming, lobes-up ascent; h) Pivoting – one lobe touches substrate while swimming, animal rotates around lobe; and i) Deceleration – animal slows and may stop before contacting the surface, in which both oral and auricular lobes are spread. In all studies, approximately 40% of behaviors involved direct substrate contact. This result is in general agreement with earlier work where animals spent 38% of their time on substrate. Rolling and hovering displayed a strong sequential correlation ($R^2=0.945$). In contrast, looping and pulsing showed very weak correlation ($R^2=0.427$). Looping was the predominant benthic behavior in all studies. Funding NSF EPSCoR EPS-047675 to R Henry and F Bartol, NSF MIP MCB-0348327 to AGM.

33. **g CONTRASTING DIFFERENTIAL GENE EXPRESSIONS TO HEAT OR FIRE ANT ENVENOMATION IN *SCELOPORUS UNDULATUS*. *Dasia Simpson*, Auburn University; *Rory Telemeco*, California State University, Fresno; *Tracey Langklide*, Penn State University; *Tonia Schwartz*, Auburn University.

Environmental stressors--such as extreme temperature change, invasive predators, and other disturbances--can negatively affect an organism's performance, survival, growth rate, and, ultimately, its fitness. The underlying molecular mechanisms of how organisms respond to diverse stressors are still poorly understood. *Sceloporus undulatus*, the eastern fence lizard, has become an ecological model organism for addressing questions in eco-physiology and life history evolution. Recently, we have developed a high-quality reference genome that furthers its utility for investigating molecular and physiological mechanisms. We are interested in understanding how stress responses may vary when an organism is exposed to diverse environmental stressors--such as an extreme heat event (as predicted by climate change), or an attack by an invasive predator, such as a fire ant. In this study, we test whether stress response to either acute heat or fire ant attack diverges at the endocrine level (plasma corticosterone levels) or at the gene expression level. We found that male *S. undulatus* ($n = 24$) which were either exposed to heat (43C) for up to 3 hours or fire ant envenomation (receiving ~10 stings) each had the same response in corticosterone levels, with an increase relative to the control. Liver RNA seq data are being analyzed to test whether the gene expression response to acute heat and fire ant envenomation is highly similar or is divergent. These results will bring further insight into the similarity of molecular responses to ecologically relevant stressors.

34. **u CREEPER ANTS TAKE THE BAIT. *Olivia Rice*, *Jacob Dittel*, *Paul Davison*, University of North Alabama.

Ants (*Hymenoptera*, *Formicidae*) are well-recognized as ecologically important and are famously one of “the little things that run the world” (Wilson 1987, Del Toro et al. 2012). Alabama is home to approximately 175 species of ants, yet for many species, little is known of their biology beyond taxonomic descriptions and spotty distributional data. *Temnothorax schaumii*, an arboreal species nesting in trees in open forests and suburban areas (Deyrup 2016), is a common ant whose biology is poorly known. In an effort to learn more about this elusive species, we tested the efficacy three types of bait (cat food, jelly, and peanut butter; $n=140$ for each bait) to recruit foraging workers in an upland oak-hickory forest in Northwest Alabama. We performed a generalized linear model (GLM) with a binomial distribution to detect if the type of bait influenced the presence of *T. schaumii* foragers. We found a significant difference among bait types ($F = 13.2$, $df = 3$, $P = 0.004$), and, using Tukey's honest significance test, we were able to determine that peanut butter recruited *T. schaumii* foragers better than cat food. There was no significant difference between peanut butter and jelly ($P >$

0.05); however, our data suggests that peanut butter may be the best bait and worthy of further comparison with jelly and other baits, with the additional aim of following foragers to their nest.

35. **g EVALUATING THE IMPACT OF PREDATORS AGAINST DIAMONDBACK TERRAPIN NESTS IN ALABAMA. *Catherine Sirgo*, Thane Wibbels, Nicole Conner, Ken Marion, University of Alabama at Birmingham.

The diamondback terrapin (*Malaclemys terrapin*) inhabits saltmarshes throughout the southern and eastern United States. This species was a valuable economic resource in Alabama during the 1800s, when tens of thousands of terrapins were farmed and shipped to the northeastern U.S. as an ingredient for terrapin stew. One of the largest farms in the U.S. was located on Cedar Point Marsh, Alabama, a major nesting beach of the terrapins. Although the terrapin was once abundant in Alabama saltmarshes, it declined significantly over the past century due to major threats, such as commercial crab fishery and increased coastal development. Now, the terrapin is a protected species in Alabama and listed as “a species of highest conservation concern”. A major problem associated with the increased coastal development is an increased number of predators such as raccoons, which prey on terrapin nests. The purpose of the current study is evaluating predator depredation of terrapin nests at the Cedar Point Marsh nesting beach during the 2019 nesting season. These areas were surveyed several times a week throughout the season to document depredated terrapin nests. Additionally, infrared wildlife cameras and wide-angle GoPro cameras were placed in experiment plots along the beach, approximately twice a week for 24-hour sampling periods, to document the presence of predators. The results indicate that raccoons are significantly impacting the survival of terrapin nests at the Cedar Point Marsh nesting beach and that their impact represents a major threat, limiting the recovery of the terrapins in Alabama.

SECTION VIII – ENVIRONMENTAL AND EARTH SCIENCES

Posters

Malia Fincher, Presiding

1. **g . THERMOREGULATORY GENE VARIATION IN THE EASTERN FENCE LIZARD (*SCELOPORUS UNdulatus*) IN RESPONSE TO SILVICULTURE TREATMENTS IN A SOUTHEASTERN HARDWOOD FOREST. Thomas *Haltigan*, Alabama A&M University; Yong Wang, Alabama A&M University; William Sutton, Tennessee State University; Venkateswara Sripathi, Alabama A&M University.

Understanding the impacts of forest management practices on habitat and wildlife community composition is essential for long-term biological conservation. The life history traits of ectothermic vertebrates, such as *Sceloporus undulatus*, are dependent on the thermal environment these organisms inhabit and thus alteration due to anthropomorphic change may influence the expression of genes that are functionally associated with thermoregulation. A large-scale field experiment, consisting of “before-after control-impact” and factorial complete block design was implemented in 2005 at Bankhead National Forest, Alabama, to evaluate the effects of prescribed fire and thinning regimes on the forest ecosystem. As an ongoing research project evaluating the responses of herpetofaunal communities, my study will evaluate both the abundance dynamics of *S. undulatus* during the thirteen years and genetic variations of *S.*

undulatus after thirteen years of the initial prescribed burning and thinning treatments. *S. undulatus* will be sampled throughout the active season which ranges from May to October each field year. Two-way analysis of variance (ANOVA) will be conducted to test treatment after x year(s) effect of the abundance of *S. undulatus*. DNA will be extracted from toe and tail clippings of *S. undulatus* collected in 2017 and 2018 using the QIAGEN DNeasy Kit and amplified via Polymerase Chain Reaction (PCR). Primer Pairs will be obtained from NCIB Primer-BLAST. Ten genes associated with thermoregulation will be sequenced and aligned with MUSCLE.

2. **u BACTERIAL COMMUNITY COMPOSITION OF BIOCHAR AMENDED SOIL.
Autumn Hill, Elica Moss, Alabama A&M University.

Climate change is one of the most critical issues concerning the modern world. The recent practice of amending soil with biochar, a carbon rich product derived from the pyrolysis of organic material at relatively low temperatures, has become a promising method to minimize atmospheric CO₂ emissions (carbon sequestration), mitigate global warming, and improve plant productivity and nutrient cycling. Biochar affects physiochemical processes and has the ability to alter microbial community composition. This study observed the predicted carbon sequestration potential of four soils amended with biochar (0 mg/ha, 5mg/h, 12.5 mg/h, 30.02 mg/h). Our study reflects a shift in microbial community structure and diversity with added biochar. Specifically, the higher bacteria diversity, increase in copiotrophic bacteria (Actinobacteria), and decrease in oligotrophic bacteria (Acidobacteria) align with the theory of enhanced copiotrophic bacteria and reduced oligotrophic bacteria contributing to an increase in CO₂ emissions. However, our study also showed that with increased biochar amendment, there was a decrease in copiotrophic (Proteobacteria, Gemmatimonadetes and Firmicutes) bacteria, which would signal a decrease in CO₂ emissions. The results reflected here confirm that biochar alters microbial communities. However, there is a contradiction in terms of whether this addition indicates the role of oligotrophic and copiotrophic bacteria in carbon sequestration and thus deems further review and analysis.

**u or **g Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION II – CHEMISTRY
Poster Session
Thursday Morning
Arthur J. Bond Engineering Building, Auditorium
Authors Set-up: Begins at 10:30 am
Authors Present: 11:00 am – noon; Viewing and Judging
Christopher Stopera, Presiding

1. **u A THERMOGRAVIMETRIC ANALYSIS OF TETRACHLOROETHYLENE-METHYL METHACRYLATE COPOLYMERS. *Peter Cote, Loren Cheatwood, Donna Perygin, Jacksonville State University.*

A tetrachloroethylene/methyl methacrylate copolymer matrix was synthesized at incremental methyl methacrylate proportions. A mass-loss event was observed when differential scanning calorimetry was performed on the resulting solid polymers. A sigmoidal curve was generated by thermogravimetric analysis. From this curve, we calculated the rate of mass-loss. The rate of mass-loss was observed to be inversely proportional to the concentration of methyl methacrylate but was still observed at 100%. We performed an evolved gas analysis to determine the composition of the volatile product.

2. **u SYNTHESIS AND CHARACTERIZATION OF LI DOPED KDP. *Niya Mayo, Kourtney Steen, Kamala Bhat, Aschalew Kassu, Alabama A&M University.*

Potassium dihydrogen phosphate (KDP) has numerous applications in opto-electronics, as a ferroelectric material in addition to being a second harmonic generator. KDP crystals can be easily grown in a laboratory. KDP is synthesized by the reaction of potassium carbonate and phosphoric acid in mole ratio. After the reaction was completed, the solution was diluted with water and heated to avoid saturation in order to grow single large crystals at a slow rate. At the same time, another set of experiments was set up to grow 5%, 10%, 15%, and 20% lithium doped KDP crystals. Initial preparation of the 5% lithium doped KDP showed that very small crystals formed quickly, rather than the 10%-20% crystals, which took much longer to form. This solution was redissolved to obtain a clear solution and allowed to crystallize slowly. The objective of this research is to compare the effect of Li dopant on the property of the KDP crystal. Characterization for each of the crystals will be presented after determining the melting point of the crystal, followed by the functional group characterization using Fourier Transform Infrared Spectroscopy, elemental analysis for metals and phosphorus using inductively coupled plasma optical emission spectroscopy (ICP-O-ES), and optical characterization by UV-Vis spectroscopy to determine the changes in the band gap.

3. **u THERMAL DEGRADATION OF POLYETHYLENE AND POLYPROPYLENE UNDER PLASTIC RECYCLING CONDITION – A STUDY OF VOLATILE COMPOUND PROFILE. *Du Luu, Logan Ledbetter, and Shaoyang Liu, Troy University.*

Although recycled plastics provide a low-cost and environmentally friendly alternative for a wide range of applications, there are several factors that significantly limit desirability for use of these plastics. Most notably among these is thermal degradation of polymers during the recycling process of these plastics, which may compromise mechanical performance and cause an unpleasant odor. In this work, a headspace solid-phase microextraction (HS-SPME) coupled with a gas chromatography-mass spectrometry (GC-MS) method was employed to help understand thermal degradations of low-density polyethylene (LDPE), high-density

polyethylene (HDPE), and polypropylene (PP) under a typical processing temperature (200°C) for plastic recycling. Volatile compounds from the three plastics before and after heating were monitored. The results show that each plastic has a unique volatile compound profile. They had notable differences in thermal stability and released different degradation products. LDPE had the lowest thermal stability among the three materials studied in this work and gave out an abundance of volatile compounds after twenty minutes of heating. Accelerated degradation of PP was detected after heating for thirty minutes, while HDPE was still relatively stable after heating for forty minutes. The volatile compound analysis carried out in this work could be used as an effective way to identify the type of plastics and evaluate their extent of thermal degradation. The results of this research may aid the plastic recycling industry in improving product quality.

4. **u SYNTHESIS OF TRIARYLSULFONIUM IONIC LIQUIDS. *Jeanette Pina*, Amanda Coffman, University of North Alabama.

Improved purification methods for the synthesis of triarylsulfonium ionic liquids is presented here. Triarylsulfonium ionic liquids are thermally robust ionic liquids (ILs) that have melting points ranging from 63-105 °C at ambient pressure. These thermally robust ILs have displayed little mass loss nor changes in structure when heated to temperatures of 300 °C for a period of 90 days. ¹Ionic liquids with such increased stability at elevated temperatures could become ideal solvents for synthetic reactions that only proceed at reasonable rates and/or provide substantial product yields at relatively higher temperatures. Additionally, the ionic nature of these salts containing large aromatic organic substituents should promote aqueous and organic miscibility, functioning as phase-transfer catalysts (PTCs) in nucleophilic reactions. [1. Siu, B.; Cassity, C. G.; Benchea, A.; Hamby, T.; Hendrich, J.; Strickland, K. J.; Wierzbicki, A.; Sykora, R. E.; Salter, E. A.; O'Brien, R. A.; West, K. N.; Davis, J. H. *RSC Advs*, 2017, 7, 13, 7623-7630.]

**u or **g Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION III – PHYSICS AND MATHEMATICS

Paper Session

Thursday Morning, 8:30 am– 12:00 pm

Arthur J. Bond Engineering Building, Room 119

Wen Yan & Matthew Edwards, Presiding

1. 8:30 HIGHLY DISPERSIVE OPTICAL SOLITON PERTURBATION WITH POLYNOMIAL NONLINEARITY BY SEMI-INVERSE VARIATIONAL PRINCIPLE. *Anjan Biswas*, Alabama A&M University.

This talk is on the dynamics of perturbed highly dispersive optical solitons that maintains the polynomial law of nonlinear refractive index. The perturbative effects stem from self-steepening and nonlinear dispersions that are considered with full nonlinearity. The semi-inverse variational principle is adopted to obtain an analytical bright 1-soliton solution to the governing perturbed nonlinear Schrodinger's equation carrying these perturbation terms. The parameter constraints, which naturally emerge from the integration scheme, are also enumerated.
2. 8:50 RAPID PARTICLE ACCELERATION DUE TO RECOLLIMATION SHOCKS AND TURBULENT MAGNETIC FIELDS IN INJECTED JETS WITH HELICAL MAGNETIC FIELDS. *Kenichi Nishikawa*, Alabama A&M University.

One of the key questions in the study of relativistic jets is how magnetic reconnection occurs and whether it can effectively accelerate electrons in the jet. We performed 3D particle-in-cell (PIC) simulations of a relativistic electron-proton jet of a relatively large radius that carries a helical magnetic field. We focused our investigation on the interaction between the jet and the ambient plasma and explored how the helical magnetic field affects the excitation of kinetic instabilities such as the Weibel instability (WI), the kinetic KelvinHelmholtz instability (kKHI), and the mushroom instability (MI). In our simulations, these kinetic instabilities were indeed excited, and particles were accelerated. At the linear stage we observed recollimation shocks near the center of the jet. As the electron-proton jet evolves into the deep nonlinear stage, the helical magnetic field becomes untangled due to reconnection-like phenomena, and electrons are repeatedly accelerated as they encounter magnetic-reconnection events in the turbulent magnetic field.
3. 9:10 **u MAPPING SOUND WAVES. *Suraj Thapa Magar*, James Sanders, Nicholas Johnson, Soumitra Ganguly, Caroline Howell, Troy University.

Intensity of sound follows the inverse square law with respect to the distance from the source. The situation becomes more complicated in laboratory conditions that include possible reflections from all surfaces. These reflective surfaces act as virtual sound sources whose contributions lead to the interference of sound waves and thus a deviation from the inverse square law due to interference between reflected waves. The frequency of waves and the dimensions of the laboratory affect the interference at various points. The frequency, amplitude, and phase shift of the various reflected waves can be used to calculate the expected intensity of

the sound at various locations within the room; this is done with a simulation in Octave. Sound intensity levels were recorded as a function of distance from the front of a speaker. This was done for twenty trials with the data binned to average out outliers, such as inconsistency in background noise as well as averaging the positions to a fixed set of distances from the source. The experimental data were found to be in good agreement with the calculations of the simulation.

4. 9:20 A SPARSE BAYESIAN VECTOR REGRESSION MODEL. *Yijun Yu*, Tuskegee University.

A sparse vector regression model is developed. The model is established by employing Bayesian formulation and trained by training data. The parameters of the model in the algorithm are reduced through taking special parameters. Therefore, the algorithm is simpler than usual and similar to the Bayesian vector regression model. Finally, the examples on test data are given.

5. 9:40 ****u** BUILDING AN ARDUINO-BASED SOUND SENSOR FOR MAPPING SOUND WAVES. *Nicholas Johnson*, James Sanders, Troy University.

The intensity of a sound wave varies inversely with the square of the distance from the source to the point at which the intensity is being measured. An Arduino-based sensor module was designed to measure the sound intensity level while simultaneously measuring the distance from the source. To build the device, an Arduino Uno was used to control the operation of a LIDAR distance sensor and a sound intensity sensor module. The purpose for building such a device is to create a more accurate and compact alternative to current data collection methods, which involves using two separate devices that attempt to simultaneously measure sound intensity level and the distance longitudinally from the sound source. Data from both methods are collected and then compared to determine if the Arduino-based device is more effective than current methods.

6. 10:20 STATISTICAL APPROXIMATIONS OF GENERALIZED NEGATIVE BINOMIAL DISTRIBUTIONS. *Salam Khan*, Alabama A&M University.

The generalized negative binomial distribution is a three-parameter distribution. This distribution is becoming increasingly useful in many branches of science, particularly related to customer service and queueing processes. Generalized distributions are becoming increasingly evident and useful in many branches of science, but the functional forms of these generalized distributions are often complicated. Therefore, a need arises for a more simplified or approximated form of this generalized distribution as well as an understanding of their relations with other distributions. Here, we approximate the generalized negative binomial distribution by using different techniques and suggest the best approximation. The results aim to fill a conspicuous gap in the mathematical and statistical literature that concerns the empirical quality of the approximations, and they are useful for designing efficient and accurate computing algorithms for such probabilities.

7. 10:40 ****u** ANGLE SCANS OF SCATTERED LIGHT INTENSITY. *Caroline Howell*, James Sanders, Nick Johnson, Troy University.

The intensity of scattered light from water droplets in steam changes when viewed from different angles. In this project, a laser is incident upon steam produced by boiling water, and it is scattered at different angles. The scattered light is then captured by a camera and analyzed in the computer program, OCTAVE. The intensity of the scattered light is dependent on the scattering angle, the intensity decreasing as the angle approaches 90 degrees from above or below. This effect can be explained by Mie Scattering, the scattering of electromagnetic waves by uniform isotropic particles. The water droplets in the steam absorb and scatter the laser and transform its energy into different forms, accounting for the low intensity at 90 degrees. This project maps the intensity of the light in OCTAVE by analyzing the pictures from different radial and polar angles.

8. 11:00 TRANSFORMING HIGH SCHOOL PHYSICS EDUCATION THROUGH TEACHER PROFESSIONAL DEVELOPMENT IN THE STATE OF ALABAMA. *Mohan Aggarwal*, Marius Schamschula, Vernessa Edwards, Barbara Cady, Dianne Kirnes, Matthew Edwards, Alabama A&M University.

The Alliance for Physics Excellence (APEX), an NSF-funded project, has successfully completed seven years of implementation. The project was comprised of several components, each with its own subset of goals and objectives that relate to the project's overarching goal of transforming secondary physics education throughout the state of Alabama. One of the goals of APEX was to provide professional development training to high school physics teachers to increase their depth and breadth of physics content knowledge and pedagogy. Each participant committed to receiving intense physics content and pedagogical hands-on training by attending two-week summer workshops and three two-day academic weekend workshops over a three-year period. Additionally, instruction was infused with technology. Many of the laboratory activities performed during the APEX professional development training examined the relationship between different variables, such as the Four Step Analysis (an online assessment tool called "Diagnoser") and action research. All of these variables were used to accomplish the goals and objectives of the project. Participants worked in teams and used white boarding to understand, use, and share concepts. Equipment was donated to the Alabama Science in Motion for their mobile truck program to ensure that participants had access to equipment on which they had been trained. Many of the APEX strategies used for instruction in high school physics classes in Alabama have been adopted and used as evidence of APEX's impact and sustainability. Highlights of this activity and its effectiveness will be presented. Details of the project and its accomplishments can be accessed online at www.alapex.org.

9. 11:20 ENHANCEMENT OF THE ELECTROACTIVE β PHASE IN THE HYDROTHERMALLY-SYNTHESIZED Pr₂O₃ NANOPARTICLE INCORPORATED PVDF FILMS. *Arun Kuzhivelil Joseph*, Mohan Aggarwal, Alabama, Ashok Batra, Alabama A&M University; Sree Kerala Varma College, Thrissur, Kerala, India.

Nanotechnologies are the design, characterization, production, and application of structures, devices, and systems by controlling shape and size at the nanometer

scale. Due to the unique physical, chemical, and mechanical properties and various potential applications, one dimensional (1-D) nanostructures have attracted great attention in the recent past. The oxide of the rare earth Praseodymium a prospective material with applications in fields like photonics, nano electronics and data storage. Poly (vinylidene fluoride), a flexible, cost effective fluoropolymer, has achieved much interest due to its wide range of significant applications. PVDF is a semi crystalline polymer, having five different crystalline phases: c.a. α , β , γ , δ and ϵ . Among all these phases, the non-polar α phase is the most common and thermodynamically stable state. On the other hand, β and γ phases are the polar phases of the PVDF. However, the polar β phase acquires more importance over the other phases due to its better piezoelectric, ferroelectric, and pyro electric properties. The present work deals with the synthesis of praseodymium oxide nanoparticles by hydrothermal method. Hydrothermally synthesized praseodymium oxide nanoparticles are incorporated in the PVDF matrix. Detailed analyses of the structural and optical properties of the PrO nanoparticles loaded PVDF films have been included in this study. The effect of the praseodymium oxide nanoparticles on the nucleation of the electro-active β phase in PVDF, along with the reason behind the significant improvement of the β phase fraction, has also been discussed from the physicochemical point of view.

10. 11:40 **u A STUDY OF LASER EXCITED FLUORESCENCE FROM RUBIES AND SAPPHIRES. *Isaiah Clotfelter*, D. Brian Thompson, University of North Alabama.

Rubies and sapphires are gem varieties of the mineral corundum. The red color of a ruby arises from trace amounts of chromium present in the corundum crystal that fluoresces red light. While the different colors of sapphires arise from trace impurities of other metals, chromium ions also exist in these gems, though in much smaller amounts. So, sapphires also fluoresce red light, although weakly. We have used green laser light to excite fluorescence in a wide variety of rubies and sapphires, collecting both spectra and lifetime measurements of the red fluorescence emission.

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SECTION III – PHYSICS AND MATHEMATICS

Poster Session

Thursday Afternoon, 1:00 pm – 3:00 pm

Arthur J. Bond Engineering Building Auditorium

Wen Yan & Matthew Edwards, Presiding

11. **g COMPOSITIONAL DEPENDENCE OF BORATE GLASSES FOR WHITE LIGHT EMISSION STUDIES. *Ashley Owens*, Alabama A&M University.

Light emitting diodes (LEDs) are efficient, energy-effective lighting solutions for commercial and residential applications. They come in two main forms: a single diode with many phosphor coatings that when excited release colored light that combines to form white light and a triple diode with a red, blue, and green configuration that combines to form white light. The problem is that many of these LEDs are made using harmful and toxic compounds, and they are expensive to purchase when compared to other lighting solutions available on the market. The purpose of this research is to develop an LED configuration that will generate white light using a single diode and a single phosphor coating while also avoiding the use of any harmful materials. Borate glasses have been proven to have optical properties suited for applications in LED lighting. Studies have shown borate glasses can generate white light when appropriate dopants are added. For this research, we will investigate the optical properties of borate glasses doped with dysprosium, samarium, terbium, and cerium in order to test its capabilities as a white light generator.

12. **u ABSORPTION AND LASER-INDUCED FLUORESCENCE STUDIES OF CHLOROPHYLL. *Clay Thompson*, Jayla Brantley, Ariana Black, Archana Sharma, Akshaya Kumar, Tuskegee University.

Chlorophyll is one of the most significant components of plants. It receives light energy from the Sun that is utilized in photosynthesis. The present study involves extracting chlorophyll from plant leaves and then recording their UV-VIS-NIR absorption spectrum and laser-induced fluorescence spectrum. The plant leaves were submerged in acidic solutions before extraction of chlorophyll. The effect on absorption and laser-induced fluorescence spectrum will be reported in this presentation.

13. **u QUANTIZED PARTICLES RESPONSIBLE FOR CONDUCTION. *Jared Savage*, Daniel Lindo, Taylor Jones, Prakash Sharma, Tuskegee University.

The work shows that the quantized particles responsible for the conduction can be calculated using the Bose-Einstein's statistics. Various approximations and the possible errors will be incorporated in the work. The n-type and p-type materials will be discussed.

14. **g INVESTIGATION OF PHOSPHATE GLASSES FOR WHITE LIGHT EMISSION. *Mersaydes Goodson*, Rami Bomareddi, Alabama A&M University.

Transparent barium phosphate glasses were created in air, utilizing the quench method. Each glass was characterized to include the trichromatic system, which suggests that white light can be created through the incorporation of the three primary colors (red, green, and blue), using samarium, terbium, and dysprosium respectively. The ratios were determined from the previous trials as were their luminescence results. The properties, emission peaks, and xy coordinates were reviewed to decide whether less or more of a material were needed. The optical emission and absorbance studies were carried out on these glasses to measure their energy levels. The emission spectra were recorded in UV-VIS region. Lifetimes were also measured. Silver particles were dispersed through the last sample. Heat

treatment was introduced to induce nanoparticles. The sample experienced multiple trials to determine if heat treatment had an effect on its luminescence properties. Metals, such as silver, gold, and copper, grow as nanoparticles upon heat treatment due to reduction and are known to enhance rare earth luminescence.

15. ****u NLP ANALYSIS AND INTERACTIVE VISUALIZATION OF MOVIE DATA.**

Sheng Gao, Mingwei Sun, Samford University.

Understanding the popularity of movies is extremely important for producers and investors. The director, actor, and genre of a movie are the selling points of a movie, but they are not static over time. My research is dedicated to crawling movie data for analysis. First, I determined the theme of the movie. Then, I acquired the data, which is cleaned and filtered and ready to be visualized and analyzed. In addition, I crawled some high-rated movie reviews from different generations. Subsequently, I used sentiment analysis function to build in an NLTK package to rate all the reviews and compare it with the scores given by the audiences.

16. ****u A SEARCH FOR VARIABLE STARS IN THE OLD OPEN CLUSTER NGC3680.**

Derick Vickery, Mel Blake, University of North Alabama.

Contact binaries are stars which orbit one another so closely that they share a common envelope. Contact binaries may form through close encounters or through stellar evolution. The youngest such contact binary is TX Cnc in the Praesepe. We have begun a project to search younger clusters to discover more contact binaries to further constrain the timescales that are required to form them. We report on a search for variable stars in the 1.2-billion-year-old cluster NGC3680.

17. ****u PHONON SCATTERING IN PURE SEMICONDUCTORS.** *Taylor Jones, Jared Savage, Daniel Lindo, Prakash Sharma, Tuskegee University.*

Phonon Scattering in pure semiconductors will be calculated by the crystal boundaries, impurities, and phonons . A model is developed and the new equation under Maxwell-Boltzmann Approximation will be presented. To test the validity of the model at low temperatures, we will apply it to calculate the phonon conductivity of a pure semiconductor and compare it with the experimental values.

18. ****u A SPECTROSCOPIC STUDY OF DELTA SCORPIUS.** *Harrison Whitaker, Mel Blake, University of North Alabama.*

We have used original and archival data to examine the changes in the H-Alpha line of Delta Scorpius, a Be star. Be stars are massive stars which have a circumstellar disk around them that varies with time. The reason for these changes is poorly understood, so monitoring these variations over time clarifies the processes. We have used 16 years of data on Delta Scorpius to study the changes in the strength of the H-Alpha line. Significant changes take place. The longest time frame is similar to the orbital period. We discuss the result of this study.

19. **THE INDIAN ANTI-SATELLITE EXPERIMENT: FRAGMENTS DISPERSION ANALYSIS.** *Arjun Tan, Alabama A&M University.*

The Indian Anti-Satellite (ASAT) experiment of March 27, 2019, created some unexpected results. Whereas the planned head-on impact of the ASAT with the target satellite was to minimize orbital debris production, the converse had happened. It has now been shown that

a series of explosions within the target following the impact was responsible for the debris production. This study analyzed the magnitude, variance, and directionality of the fragments produced. It found that 95% of the fragments were ejected in the forward direction, 69% were ejected in the downwards direction, and 80% were ejected rightwards of the target when viewed from above. More than half of the fragments (58%) were ejected within just one octant (Octant VIII) of space. The angular distribution of the fragments was studied by defining angles of latitude and longitude at the breakup point and plotting them in an equidistant cylindrical projection map. The map clearly shows that the majority of the fragments were concentrated in a narrow solid angle within Octant VIII. The most energetic fragments, located near the periphery of this octant, strongly suggest that the target fragmented in the ‘Clam’ model of explosive fragmentation of propellant tanks.

20. **u ENERGY GENERATION FROM TRANSISTORS. *Mordecai Israel*, Rebecca Glenn, Zhigang Xiao, Alabama A&M University.

In this project, we researched the properties of transistors and, as such, will discuss transistors and how to generate power from them despite their size. Also, we will examine if other metal transistors behave better than silicon transistors. We have completed processes like deposition spin coding, photo lithography, EV evaporation, liftoff, and plasma etching/wet etching in order to evaluate the behavior of the transistors. These processes will assist in characterizing the transistors and help develop their functionality.

21. A CME-PRODUCING SOLAR ERUPTION FROM THE INTERIOR OF A TWISTED EMERGING BIPOLE. *Mitzi Adams*, Marshall Space Flight Center; Ronald Moore, University of Alabama in Huntsville; Sanjiv Tiwari, Lockheed Martin Solar and Astrophysics Laboratory; Navdeep Panesar, Lockheed Martin Solar and Astrophysics Laboratory; David Falconer, University of Alabama in Huntsville.

In a negative-polarity coronal hole, magnetic flux emergence, as seen by the Solar Dynamics Observatory's (SDO) Helioseismic Magnetic Imager (HMI), began at approximately 19:00 UT on March 3, 2016. The emerged magnetic field produced sunspots with penumbrae by 3:00 UT on March 4, which NOAA numbered 12514. The emerging magnetic field is largely bipolar with the opposite polarity fluxes spreading apart overall. However, there is simultaneously some convergence and cancellation of opposite polarity flux at the Polarity Inversion Line (PIL) inside the emerging bipole. The emerging bipole shows obvious overall left-handed shear and/or twist in its magnetic field and corresponding clockwise rotation of the two poles of the bipole about each other as the bipole emerges. The eruption comes from inside the emerging bipole and blows it open to produce a CME observed by SOHO/LASCO. That eruption is preceded by flux cancellation at the emerging bipole's interior PIL, a cancellation that plausibly builds a sheared and twisted flux rope above the interior PIL and finally triggers the blow-out eruption of the flux rope via photospheric-convection-driven slow, tether-cutting reconnection of the legs of the sheared core field, low above the interior PIL, as proposed by van Ballegoijen and Martens (1989, ApJ, 343, 971) and Moore and Roumeliotis (1992, in *Eruptive Solar Flares*, ed. Z. Svestka, B.V. Jackson, and M.E. Machado [Berlin:Springer], 69). The production of this eruption is a (perhaps rare) counterexample to solar eruptions that result from external collisional shearing between opposite polarities from two distinct emerging and/or emerged bipoles (Chintzoglou et al., 2019, ApJ, 871:67).

22. ****u EFFECTS OF DOPING WITH MWCNT ON BANDGAP ENERGIES IN COMPOSITE THIN FILMS.** *LaMaia Sanders*, Alabama A&M University.

There are numerous applications for the pyroelectric composite films in the medical field, construction field, and environmental applications field. The main focus of this research is to study the effects of MWCNT doping on the composite films' bandgap energies and thus, the optical properties of the films. PS is a manmade polymer that has been proven to be an excellent choice in sensing devices. PS is very useful when the detector is flexible, light weight, and possess high pyroelectric current and resistance. PS is also very useful when the detector has low dielectric constant and densities. In this research, PS films are doped with MWCNT, PS: ZnTiO₃. Thin films, pure and doped with MWCNT, are fabricated using the solution casting technique. Films fabricated were characterized for their optical and structural properties using FTIR Spectroscopy. Results showed that the bandgap is reduced in all the films with the additional amount of PS: ZnTiO₃ shows highest change in the bandgap energies. The decrease in the bandgap may be attributed to the presence of unstructured bulk defects. Obtained results show that the quantitative doping of PS and its nanocomposite material with MWCNT is enhancing the key characteristics of the materials that are beneficial for the optical devices industry.

23. ****g IMPROVISING THE PERFORMANCE OF FERROELECTRIC POLYMER NANOCOMPOSITES VIA PEROVSKITE MATERIALS.** *Sharvare Palwai*, Padmaja Guggilla, Alabama A&M University.

In the recent years, nanocomposites have exhibited a catalytic role in improving electronic and optoelectronic properties of conventional ferroelectric polymers, such as Polyvinylidene Fluoride (PVDF). However, perovskite materials, when slightly tuned, can create results appearing to have towering absorption potential, lower bandgap, higher dielectric constant, and more. In the present work, the influence of perovskite materials, such as calciumtitanate (CaTiO₃/CT) and zinc titanate (ZnTiO₃/ZT), in polymer films have been comprehensively studied. Films fabricated were characterized for optical studies that displayed improved absorption and finer spectral analysis.

24. ****g DEVELOPMENT OF NANOCOMPOSITE FILMS FOR BIOMEDICAL APPLICATIONS.** *James Sampson*, Adina Showe, Ashley Lewis, Ashok Batra, Kuzhivelil Arun, Alabama A&M University.

Polyvinylidene fluoride (PVDF) is utilized in a wide range of devices due to its excellent mechanical and optical properties, high thermal and chemical stability, piezoelectricity, Pyroelectricity, and ferroelectric responses. In the present investigation, the praseodymium oxide nanoparticles embedded into polyvinylidene fluoride (PVDF) thick films were fabricated via solution casting/intercalation technique. The praseodymium oxide nanoparticles were synthesized via hydrothermal technique. The Fourier transform infrared spectroscopy (FTIR) has been recorded in the range 500 to 4000 cm⁻¹ and functional groups were identified in the nanocomposite films. Infrared vibrational spectroscopy (FTIR) revealed the presence of ferroelectric β -phase in the annealed nanocomposite films intrinsically. The electrical parameters, including piezo-capacitive and piezo-resistive, were determined. The results of their characteristics for use in biomedical applications will also be presented.

25. THE INDIAN ANTI-SATELLITE EXPERIMENT: PUZZLES AND ANSWERS. *Arjun Tan*, Alabama A&M University.

The Indian Anti-Satellite (ASAT) experiment of March 27, 2019, created some controversy. The destruction of the target satellite Microsat-R was planned by a head-on collision with a kinetic kill vehicle (KKV) so that most of the fragments produced by the backward impulse would deorbit rapidly and pose no threat to the space environment. However, several hundred fragments were spread forward and into higher orbits. This unexpected puzzle has been solved in this study by analyzing the collision via through orbital mechanics. The results show that, whereas collision alone was not responsible for the debris production, explosions resulting from the collision explain the fragments formation in the forward direction. Careful examination of the ‘Gabbard diagram’ suggests that at least two secondary explosions following the primary explosion took place after the target satellite was knocked into an elliptical orbit as a result of the collision with the ASAT.

26. . OBTAINING ELLIPTICAL SECTIONS BY INTERSECTING A RIGHT-CIRCULAR CONE WITH A PLANE. *Arjun Tan*, Alabama A&M University.

The popular topic of obtaining conic sections by intersecting right-circular cones with planes is readily found in books, journals, and the internet. However, a mathematical analysis of this topic is hard to find because a simple derivation has not been available to show that the outlines of the planar sections of conics indeed satisfy the equation of that conic. In this study, we show that one can obtain the Cartesian equation of an ellipse without too much mathematical intricacy. This process can be best demonstrated by intersecting a right-angled, right-circular cone with a plane. Elliptical shapes of any desired size and eccentricity can be made by choosing the slicing angle of the plane and the vertical intercept.

27. . SEMI-EMPIRICAL/ANALYTICAL FORMULAS FOR OPENING WICKET PARTNERSHIP IN TEST CRICKET. *Arjun Tan*, Alabama A&M University.

The opening wicket partnership is one of the most important factors which the outcome of a cricket match depends. In this study, the greatest opening partnerships in test cricket are studied, and various semi-empirical/analytical model partnerships are constructed in lieu of fully analytical ones. Factors such as the cumulative distribution of batting scores, the role of extras, and equal and unequal partners can be considered analytically. However, the correlation coefficient between the partners’ batting scores plays an all-important role which can only be incorporated empirically.

****u** or ****g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION IV. ENGINEERING AND COMPUTER SCIENCE

Paper Session

Thursday Morning, 10:00 – 11:00 am

Arthur J. Bond Engineering Building, Room 103

Ravi Gollapalli, Presiding

1. 10:00 **u AN INTRODUCTION TO OBJECT-RELATIONAL MAPPERS. *Michael Porter*, Alabama A&M University.

In an effort to write better code, software developers have created tools called object-relational mappers (ORMs). These ORMs utilize object-oriented programming (OOP) concepts, such as data encapsulation and inheritance, to directly integrate the data tier into the application tier, which produces software that is overall more secure, less prone to bugs, and easier to maintain and further develop. Whereas developers used to have to write their data and application tiers using two different programming languages (usually SQL and another language), ORMs allow them to write both tiers using the same language, therefore reducing the amount of complexity and knowledge that is required by developers. ORMs allow developers to define their data structure and perform all the fundamental data operations using object-oriented styles. In this paper, we provide an introduction to ORMs in order to show how they can be used to filter, insert, update, and delete data, as well as compare them to the equivalent SQL code for each operation.

2. 10:20 SURFACE ENGINEERING OF BIOMATERIALS USING COLD PLASMA PROCESSING. *Vinoy Thomas*, University of Alabama at Birmingham.

Low, temperature cold plasma can initiate chemical reactions that produce different reactive radicals, charged particles, ions, and UV light. Active species can be used for biomedical and soft-biomaterials surface engineering/modification for biointerface applications. Accordingly, nanofibrous tubular tissue-scaffolds (4-mm diameter), for potential use as vascular-graft, were spun from both biodegradable and biostable graft polymers. Both biodegradable and biostable graft polymers, such as polycaprolactone (PCL) or Dacron (PET), were allowed to interact with LTP Plasma under various gas conditions. Electrospun into thin nano/microfibers to form seamless 3D-conduits of 4-mm intimal diameter, the tubes were exposed to dielectric barrier discharge using controlled gas flow into ambient atmosphere. For the optimization of the plasma process required for surface modification of intimal surface of tubes, the system parameters, such as feed gas composition and electric power, were varied. The variation of the feed gas from Ar, He, air, air/He, and air/ammonia was studied. Surface characterizations were done using x-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), and glycerol contact angle (GCA) measurements for surface chemistry, morphology and wettability. The overall results indicated a facile method for intimal surface modification for blood/tissue interactions.

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SECTION IV. ENGINEERING AND COMPUTER SCIENCE

Poster Session

Thursday Morning/Afternoon

Arthur J. Bond Engineering Building, Auditorium

Authors Set-up: Begins at 11:00 am

Authors Present: 11:30 am –1:00 pm

Ravi Gollapalli, Presiding

3. ****u RAMAN SPECTROSCOPIC STUDY OF BUILDING FIRE-BARRIERS.** *Tyra Harris, Aschalew Kassu, Anup Sharma, Alabama A&M University.*

The use of Raman spectroscopy for the characterization of construction materials and forensic analysis of ancient building materials is becoming an area of interest in construction and civil engineering research. Portable and standoff Raman spectroscopy is a promising technique for characterizing construction materials in a laboratory setting and for non-destructive evaluation. Portable and standoff Raman spectroscopy also includes forensic analysis of defects and deterioration of civil engineering structures in an outdoor environment. This step eliminates the need to collect a sample from the building part and eliminates structural damage. Fire-barrier sealants are construction materials used to stop the spread of fire and smoke through openings created by electrical and mechanical system pipes and other openings in walls, floors, and ceilings for up to four hours. Several brands of fire-barriers are commercially available with distinct differences in the composition of the constituent materials. In this research, Raman spectroscopic technique was used to characterize fire-barriers obtained from local suppliers without further processing. The paper reports the characteristics of the different Raman bands used in the research. The paper also reports and discusses the elemental composition of the construction material.

4. ****u QUALITY ASSURANCE AND RELIABILITY ANALYSIS IN ADDICTIVE MANUFACTURING.** *Adedotun Ayokanmbi, Alabama A&M University.*

This work summarizes the experimental results and the analysis of 3D printed parts using Fused Deposition Modeling (FDM). The testing procedures have been performed according to the ASTM D3846–02 method for defining the in-plane shear strength while the ASTM D5379 method has been used for determining the out-of-plane shear properties. Hence, specimen dimensions, testing methods, procedures, loading jig, tightening torque, and other recommendations have been used during this investigation. Reliability analysis has been performed for determining the Probability density function, the survival function, and the hazard function. A comparison between parts manufactured using the 3D printer and the commercial manufacturing process have been performed using a two-sample Kolmogorov-Smirnov normality test of the underlying distributions which was supported by Mann-Whitney test.

5. ****u RELIABILITY ANALYSIS BASED APPROACH TO IDENTIFY VEHICULAR CRASH POTENTIALS OF STATE HIGHWAYS AND COUNTRY ROADS IN MISSOURI USING THE EQUIVALENT PROPERTY DAMAGE ONLY CRASH INDICATOR.** *Fermin Ruiz Crespo, Sudip Bhattacharjee, Alabama A&M University.*

Vehicular crashes are common on state highways and county roads which carry three fourths the United States' total traffic. These crashes frequently result in fatality and/or severe injuries and property damages which cost millions of dollars in public litigations and compensations.

One of the major problems faced by traffic engineers is that there is a high level of uncertainty in predicting the number of crashes. The goal of this research is to determine a methodology based on reliability analysis of crash data which incorporates the uncertainty in crash prediction and identifies the locations for future potential crashes. This research is expected to save lives and property by reducing the number of crashes. The reliability is defined as the probability that number of crashes will be less than or equal to a given threshold level. The results showed that three out of the ten sections of roadways indicated very low reliability levels with high crash potential needing immediate attention. The sections were ranked from lowest to the highest reliability. The model accurately predicted crashes 95% of the time. The 95th percentile ranking also matched with the reliability ranking. The reliability and 95th percentile values for the sites correlated with the corresponding high number of crashes observed for the sections, thus validating the approach. The results showed that the reliability-based crash prediction approach can successfully identify the roadway sections that need further improvements even with including the effect of uncertainties in the predicted crash numbers.

6. ****u ANGEL SCAN: A NOVEL APPROACH OF USING MACHINE LEARNING TO DETECT ABNORMALITIES IN MEDICAL IMAGING.** *Georgiana Wright, Marius Schamschula, Alabama A&M University.*

Approximately 41,000 women in the US were expected to die from breast cancer in 2018. Mammograms are needed to find breast cancer, yet the cost for a mammogram from a radiologist can be over \$1,000. This cost exceeds the \$50 Medicare reimbursement, which can cause financial burden for patients. High mammogram costs cause patients to turn down proper treatment to protect their finances. To decrease this problem, we created a machine learning tool with image recognition features that reads mammograms and classifies them. This machine acts as a trained radiologist by identifying normal shapes or irregular abnormalities. PyCharm was used as the developing environment to use during this experiment. The data was collected from the MIAS Mini-Mammographic Database, which was created by organizations of UK research groups. The database contains 322 mammograms. It also includes radiologists' markings on the locations of abnormalities within the images. The images were downloaded and stored in PyCharm. Then the program associates the classifications to mammograms and inputs them into the ML algorithm for each of the mammograms. The images in the database are used to train the model to learn abnormalities. In 7 hours, the computer ran 345 of the 30,000 iterations. The results of iterations were outputted in the Google Kubernetes system. The results were limited by time and Kubernetes capabilities. I will be using results for future research by limiting iteration time and switching to the MURA imaging database to train a new model.

7. ****u SPECTRAL CHARACTERIZATION OF SEALANTS USED IN CONSTRUCTION INDUSTRY.** *Kwaneitra Powers, William Petway, Aschalew Kassu, Anup Sharma, Alabama A&M University.*

This paper presents the results of the Raman and FTIR (Fourier-Transform Infrared) spectroscopy study of ten different commercially available silicone-based sealant materials widely used in commercial and residential buildings. Both Raman and FTIR techniques have been widely used in the characterization of pharmaceutical products, mineralogical compositions, petroleum industry, forensic research, food sciences, semiconductor, and agro-industries. This work demonstrates the application of Raman and FTIR analysis in the study of construction materials and reports the spectral signatures of the selected building sealants

commonly used in the construction industry. This study found that there are several vibrational bands that are common to some of the samples. This suggests that there was a reasonable similarity in the molecular composition of the samples drawn from three different manufacturer brands: DAP, GE, and HDX. Despite the degree of similarities in the spectral bands of the samples studied, Raman spectroscopy and FTIR techniques provided enough evidence to distinguish the samples and suggest that the molecular structure of most of the silicone brands possess unique signatures.

8. ****u ANALYSIS OF CONSTRUCTION WORK ZONE CRASHES IN ALABAMA.** *Hiram Davis, Virgil Studdard, Aschalew Kassu, Mahbub Hasan, Anup Sharma, Alabama A&M University.*

According to the National Work Zone Safety Information Clearinghouse (www.workzonesafety.org) report, nationally, the 2018 work zone fatal crashes & fatalities were 671 and 754 respectively. In the state of Alabama, there were 23 work zone related fatal crashes resulting in 27 fatalities. As compared with the fatal and non-fatal injury crashes that occurred on non-work zone segments of the highways, the number of crashes that happened in construction work zones is relatively small. However, the growing prevalence of crashes is a concern for construction workers, the roadway users, and state and federal transportation stakeholders. This paper presents the safety effects of several variables including posted speed limit, time of the day, day of the week, lighting condition, weather condition, the functional classification of the roadway, the driver's gender, driver's age and condition on the likelihood of occurrences of highway construction work zone related traffic accidents in Alabama. The study analyzes the severity and the frequencies of the crashes observed in several individual work zone locations on freeways, rural and urban designation of the highway segments. The factors contributing to the traffic accidents within the highway work zones are identified and presented.

9. ****u PROTOTYPING A SPATIAL ATOMIC LAYER DEPOSITION SYSTEM FOR FASTER NANOMANUFACTURING.** *John Lucius, Tingyi Wei, Griffin Tull, Dongqing Pan, University of North Alabama.*

Atomic Layer Deposition (ALD) is a technique used to create thin film layers for micro components and microstructures such as transistors, processors, and memory drives that are crucial components extensively used in everyday electronic devices such as smartphones, computers, and gaming systems. ALD is a proven effective nano-manufacturing technique used to deposit nano-scale thin films with remarkable uniformity and conformity in surface geometry. However, confined by the fashion of alternately injecting chemicals to enable the surface reactions, ALD is very slow process. For instance, a conventional single wafer ALD system can only achieve a few nanometers of layer thickness per minute of deposition. Therefore, this project is dedicated to designing and developing a spatial ALD system, which adopts the spatial concept to deposit materials much faster than the traditional way of ALD by eliminating the significant amount of waiting time. Three different system designs were proposed, designed, and developed. Then, the flow in spatial ALD was simulated using the computational fluid dynamics method. Three different prototypes based on the designs were created and developed, and flow tests were carried out. The effectiveness of separating gases in the spatial ALD system were tested and verified.

SECTION V – SOCIAL SCIENCES
Paper Session I
Thursday Morning 9:00 am – 11:00 am
Arthur J. Bond Engineering Building, Room 102
Susan D. Herring, Presiding

1. 9:00 THE CAUSES OF HOMELESSNESS AND THE CHARACTERISTICS ASSOCIATED WITH HIGH RISK HOMELESSNESS: A REVIEW OF INTERCITY AND INTRACITY HOMELESSNESS DATAT. *Deden Rukmana*, Alabama A&M University.

Two different city-level homelessness data types, intercity and intracity data, have been used by many homelessness studies in the United States. Intercity homelessness data are collected through cross-sectional surveys to estimate the number of persons experiencing homelessness in each city or metropolitan area. Intracity homelessness data are collected through prior address information reported by persons experiencing homelessness within a city's jurisdiction. This article reviews and compares both city-level homelessness data types. The comparison of intercity and intracity data offers insight into the strength and weaknesses of each data type in identifying the causes of homelessness and the characteristics associated with a high risk of homelessness. Intercity homelessness data examine the effect of policy and institutional variables and community-level variables that vary across cities on the prevalence of homelessness. Meanwhile, intracity homelessness data focus on the spatial variation of demographic, socioeconomic, housing, and other neighborhood factors that contribute to the incidence of homelessness within a jurisdiction that has the same policy and institutional variables. The findings from intracity and intercity homelessness data are not contradictory but complementary. The complementary findings between intercity and intracity homelessness data provide important information for planners to address homelessness at local levels.

2. 9:20 MANAGING CONTRACTS: DOD APPROACH.. *Charles Roberts*, Bryan Kennedy, Athens State University.

This case study has been conducted to identify and analyze the ineffective and inefficient practices within the DOD contract management process. The research for this project utilized both secondary analysis and survey analysis to pursue the formation of hypotheses and evidence-based solutions. An analysis of 14 secondary sources was conducted in conjunction with a survey that netted 156 respondents, from both government and contractor entities, of 8 carefully constructed questions regarding the contract management process. The results of the secondary analysis and corresponding survey responses showed several problems within the DOD contract management process. The problems identified were excessive fraud, waste and abuse, deficiencies in workforce training and development, improper employment of contract types, enlistment of contract services when DOD personnel can handle the work, inadequate contractor reporting requirements and overfunding.

3. 9:40 CONTRACTING IN THE PRESENCE OF INSURANCE: THE CASE OF BIOENERGY CROP PRODUCTION. *Mohit Anand*, Miles College; *Ruiqing Miao*, Auburn University; *Madhu Khanna*, University of Illinois at Urbana-Champaign.

The recent billion-ton study (USDOE 2016) envisions miscanthus and switchgrass as two promising bioenergy crops meeting a dominant share of the billion tons of biomass supply in 2030. Similar to conventional crops, yield and price risks are prevalent in bioenergy crop production. Moreover, the availability of crop insurance for conventional crops makes the production of bioenergy crops without crop insurance relatively riskier than conventional crops. Therefore, risk management strategies and the need for coordination of biomass supply between farmers and bio-refineries is likely to necessitate reliance on long-term contracts and on insurance programs for bioenergy crops. A few recent studies have investigated contracts for bioenergy crops or the effects of crop insurance on bioenergy crop production. However, none of these studies considers the interaction between contracts and crop insurance for bioenergy crops. In this paper, we investigate the interaction of crop insurance and contracts in improving the risk management ability of farmers who produce bioenergy crops. Numerical simulation was conducted for 1,919 U.S. counties east of the 100th Meridian that had yield data for corn and for at least one of miscanthus and switchgrass. The purpose of this paper is to investigate how crop insurance for bioenergy crops affects the optimal contract design and land allocation under three types of contracts (namely, fixed price contract, land lease contract, and revenue sharing contract).

4. 10:00 AN ETHICAL DILEMMA, OR DIFFERENT PERSPECTIVES. *Thomas Pieplow*, *Bryan Kennedy*, *Susan D. Herring*, Athens State University.

This case study presents micro-shots of group dynamics occurring in the same general time frame in a large bureaucratic federal organization. On the surface, the events appear to be independent of each other. Your responsibility in responding to the case study is to decide if the events are related or unrelated and to determine how management might best handle the situation.

9. 10:20 CLIMATE-INDUCED RISKS, FOOD SECURITY, AND RESILIENCE IN THE DEEP SOUTH. *Berneece Herbert*, *Judith Oppong*, Jackson State University; *Colmore Christian*, Alabama A&M University.

The magnitude of climate-induced impacts on the lives and livelihood of people and communities is projected to intensify further, as evidenced by the increasing occurrence and intensity of disasters, such as tornadoes, fires, floods, and droughts. Most of the current research addresses resilience and adaptation at the national level, but little is known about community-scale interventions. An analysis of the literature on community-based disaster preparedness indicates that communities' roles in responding to climate-induced risks are critical; however, most of these efforts may only focus on the short-term response and not on the systemic changes that may be required for long-term reliance and sustainability. This research focuses on climate-induced flooding risks in select communities in Mississippi and Alabama and the possible impacts on food security and community resilience. The aim is to build a database of community-scale climate adaptation measures that were being used or had been used in these communities. This work is an adaptation of research undertaken by *Choko et al. (2019)*, who assessed the sources of climate

risk and community-based actions for climate change adaptation in six communities in southeastern Nigeria. This research assesses the opinions of community organizations regarding the effectiveness, constraints, and benefits of community-level adaptation measures and possible impacts on food security and sustainability.

10. 10:40 ****u** THE HISTORY OF UNIONIZATION. *Angela Miller*, Bryan Kennedy, Athens State University.

Unions developed because of a need to protect workers. Before unionization, working conditions were often hazardous and very poor. Many employers had no regard for the safety or lives of their workers, as evidenced by the 1911 Triangle Shirtwaist Factory fire in New York. This poster illustrates the need to improve working conditions for workers and hold employers accountable. It also shows the history of unions from the small guilds created by craftspeople to the major labor organizations of today, including AFL-CIO and UAW. Despite many trials and setbacks in the early days of unionization, unions still produced better working conditions for employees through government regulations, a standard workweek, and minimum wage pay.

****u or **g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION V – SOCIAL SCIENCES

Paper Session II

Thursday Afternoon 1:00 pm –3:30 pm

Arthur J. Bond Engineering Building, Room 102

Susan D. Herring, Presiding

7. 1:00 THE DEVELOPMENT OF A COMPETITIVE-ADVANTAGE MODEL FOR ONLINE EDUCATION IN A SMALL STATE UNIVERSITY. *Michael Essary*, Athens State University.

In the 2000s, changes in the external environment, including changing student demographics, increased competition, and declining government support, are affecting public higher education administrators. The growth in online enrollment is increasing at a rate higher than the total higher education enrollment, and most university leadership indicates online education is essential to their institutions' future strategies. A review of the literature shows a lack of planning tools for public higher education administrative decision-making regarding an efficient balance of traditional and online courses. One type of planning tool that could be effectively used for higher education administrative decision-making is a competitive-advantage model. The purpose of the current qualitative, exploratory, multiple-case study was to create a competitive-advantage model for online and traditional education that would assist university leadership in strategic decision-making. The emergent study themes were management, distance learning cost, funding, competitive issues, faculty concerns, community interactions, and students. The study results included four key factors that establish the limits of what a public institution can successfully achieve: institutional strengths and weaknesses,

institutional opportunities and threats, broader societal and taxpayer expectations, and the personal values of the institution. The competitive-advantage model for online and traditional education decision-making developed in this study, if implemented and applied effectively, could become an important tool for ensuring the continued existence and profitability of small colleges.

8. 1:20 EDUCATIONAL STRATEGIES FOR MASTERY LEARNING IN HIGHER EDUCATION. *Dana Wilchcombe*, Alabama A&M University.

The term mastery learning was coined by John B. Carroll when he measured the amount of time on task for a person to learn. He suggests that enough time on task impacts achievement. Students in higher education can learn everything they are taught at a mastery level with little expenditure of instructional effort (Guskey 2007). The notion is that teachers should manage learning more than learners by setting goals. This study seeks to discover which teaching method—KWL or KWHL—is more likely to produce better mastery learning outcomes. This study utilized a quantitative approach in which data were collected from participants in two general education courses. The findings suggest that KWL is more effective than KWHL. The group that employed the KWL graphic organizer had a mean score 10.5 SD 1.4. The group that used the KWHL graphic organizer had a mean score 8.96 SD 1.7. There was a mean difference of 1.5825; $F = 46.15$, $p < .000$. The partial $\eta^2 = .518$, indicating a strong size effect.

9. 1:40 ALBERT EINSTEIN AND THE FRINGE SCHOLARS: IMMANUEL VELIKOVSKY AND CHARLES H. HAPGOOD. *Ronald Fritze*, Athens State University.

Albert Einstein has a well-deserved reputation as the greatest scientist of the twentieth century. He was also a true humanitarian and a scholar who kept his mind open to new ideas. Many people approached Einstein for advice and support. Some of these people were engaged in what seemed to be dubious scholarship at the time and now is almost universally considered pseudoscience or pseudo-history. Velikovsky and Hapgood both fall into this category, and both approached Einstein for support. Velikovsky is best known as the author of *Worlds in Collision*, while Hapgood is best known as the author of *Maps of the Ancient Sea Kings*, a classic of the pseudo-history of cartography. This paper examines Einstein's relationship with these two men based on their correspondence, which can be found in the Velikovsky archives and in the Einstein papers at the Hebrew University of Jerusalem.

10. 2:00 THE RELATIONSHIP BETWEEN MINDFULNESS AND SLEEP QUALITY IS MEDIATED BY EMOTION REGULATION. *John Shelley-Tremblay*, Garret Talley, University of South Alabama.

Psychological research has long investigated mindfulness-based approaches, such as mindfulness-based stress reduction (MBSR), for improving behavioral and physical health outcomes, including recovery from cardiovascular disease, weight reduction, and the management of Generalized Anxiety Disorder. Relatively little is known about the relationship between mindfulness and a critical health determinant, sleep quality. This talk reports on the results of a novel empirical

study of 403 college undergraduates from a mid-sized southeastern university. The students completed an extensive self-report assessing mindfulness, emotion regulation, stress coping, and sleep quality, using the Pittsburgh Sleep Quality Index (PSQI). The results of the study indicate that only certain aspects of mindfulness, those that are more affective as opposed to cognitive, are related to scores on the PSQI. This relationship is mediated to a large extent by the level of emotional control and reactivity participants exhibit after a stressful event as measured by the Impact of Events Scale. Results are discussed in terms of a biopsychosocial model of wellness.

11. 2:20 PERCEPTIONS OF OPEN EDUCATIONAL RESOURCES AMONG STUDENTS AND FACULTY. *Susan D. Herring*, Athens State University.

The use of Open Educational Resources (OER) in higher education has proliferated over the past ten years. These resources include textbooks, teaching materials, and supplementary materials, the majority of which meet the same quality standards as traditional materials. OER have many advantages over traditional, print resources: they come at no or low cost, they can be modified to meet the specific needs of faculty and students, and students have immediate access to materials from the beginning of the class. Research studies indicate that students using OER achieve similar levels of success as those using print sources. However, research also shows that, although students appreciate OER, they tend to prefer print resources. The study described here focuses on reasons for this student preference. It was done in preparation for a larger study examining faculty perceptions of their students' attitudes toward and use of OER.

12. 2:40 ****u** (POP) CULTURAL GEOGRAPHY: *FROZEN AND HOW TO TRAIN YOUR DRAGON*. *Kaitlin Rayburn*, Jacksonville State University.

Pop culture (movies, books, video games, and more) uses human geography to express and represent different cultures. Each of these stories gives us more than entertainment; they inform us about these regions and provide good examples of how geography is influenced by place and people. This paper examines and compares how pop culture represents the Norse region. Pop culture does not just represent these cultures: it also transforms them to highlight or omit certain aspects of a people, place, or region. The *Frozen* franchise and the *How to Train Your Dragon* franchise take place in the same region but tell different stories and represent two different cultures through their geography. *Frozen* represents economic geography and later explores Norse paganism's culture but also anthropomorphizes geography to a mythical level. *How to Train Your Dragon* tells its geographic tale through voyaging, conquest, and tradition. Later it builds off Viking culture and touches on the issues of war. Both these stories are told through a positive lens, but looking closely they are more than just fun stories for kids—they offer a geography worth exploring.

****u or **g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION V – SOCIAL SCIENCES
Poster Session
Thursday Morning/Afternoon
Arthur J. Bond Engineering Building, Auditorium
Authors Set-up: Begins at 7:30 am
Authors Present: 11:00 am-1:00 pm; Viewing and Judging
Susan D. Herring, Presiding

13. **u PERSONALITY TRAITS FOR SUCCESSFUL NEGOTIATION. *Jonnie McCarley, Bryan Kennedy, Athens State University.*

When a union gains exclusive recognition in an organization, or when a collective bargaining agreement comes up for renegotiation, the management and the union parties must choose a bargaining team. During the process of compiling a team of individuals for the bargaining table, both parties should look for personalities that can collaborate on the topics up for discussion. While no one individual has all the desired characteristics, a few key traits to look for are high self-efficacy, extroversion and agreeableness, high self-monitoring, cognitive ability, and perceptive talking ability. A variety of these characteristics makes a smooth negotiation process for both sides.

14. **g SUICIDE BY FIREARM IN ALABAMA. *Raven McClellan, Mattea Parker, Austin Spencer, Imani Irby, John Heath, Tuskegee University.*

Death by gunfire in the United States has been ruled a public health crisis. In 2017 alone, 39,773 people died from gun-related injuries in the U.S., a rate of 12.0% per 100,000 population. Of those, 60% (23,854) were suicide by gun, a rate of 6.9 per 100,000. The percentage of suicides using a firearm compared to other methods was 51%. For the same period of time, the firearm death rate for Alabama was 22.9 per 100,000 (1,124), almost double the national rate. This ranks Alabama second in the nation only to Alaska, which has a rate of 24.5 per 100,000-- but a much smaller population, resulting in only 180 deaths. Of the 1,124 firearm-related deaths in Alabama, 834 were suicide (74%). The most recent data (2017) showed 51% of U.S. suicides used firearms, while approximately 69% of suicides in Alabama used guns. The most common and most lethal method of suicide is by firearms. The Dickey Amendment, a provision first inserted as a rider into the 1996 US omnibus spending bill mandated that "none of the funds made available for injury prevention and control at the Centers for Disease Control and Prevention may be used to advocate or promote gun control." This has produced a scarcity of funds for research on firearm-related suicides over the last 23 years. . In order to address the public health crisis stemming from gun-related suicides, research is urgently needed, preferably with a solution that respects the Second Amendment rights of the Alabama populous. **WORKPLACE BULLYING: LOSE-LOSE SITUATION.** *Kaliah Robinson, Sadguna Anasuri, Alabama A&M University.*

Workplace bullying is problematic for businesses and employees, and yet many employers and employees often ignore it. This is potentially related to work environments that offer people in power a sense of privilege to treat their subordinates poorly. Because of this hierarchy, subordinate employees often hesitate to challenge maltreatment. Although it is more commonly recognized between subordinates and supervisors, the act can also transpire between colleagues. Employees may accept the circumstances in an attempt to avoid conflict or termination. During 2017, over 60 million Americans experienced workplace bullying.

These behaviors include harassment, intimidation, and use of excessive power. Policies to control such immoral behaviors are frequently non-existent or ineffective. The current policies and procedures on workplace bullying are failing because Human Resources professionals find it hard to respond to employee complaints of harassment because of blurred definitions and unclear policies. Being subjected to a toxic work environment can have a detrimental impact on the physical and mental health of employees, which directly impacts their organizations. As a result, employees may suffer from stress-related diseases, causing them to take time off work, or they may lack focus and perform poorly during work. Such employees may feel a sense of hopelessness, anger, depression, and in extreme cases, suicidal thoughts. Furthermore, workplace bullying may impact family life, parental relationships, and spousal dynamics. The purpose of this poster is to highlight the impact of toxic work-spaces on individuals and explore and enforce necessary training for prevention and intervention.

15. **g DAMSELS IN DISTRESS: HEALTHCARE DISPARITIES AGAINST AFRICAN-AMERICAN WOMEN. *Melissa Robinson*, Sadguna Anasuri, Alabama A&M University.

Social injustices in the United States cover a broad spectrum of overt bigotry and biases. Racism, prejudices, and discrimination are deeply rooted in the US legal and social structures. This often leads to systematic oppression of minority groups in all aspects of life. An alarming rate of minorities are becoming victims of racial profiling and police brutality, which has been publicized recently via media. However, the healthcare disparities often do not see the limelight, specifically those affecting African American women. Women of color often receive lower-quality healthcare and are subjected to callous treatment by medical professionals. With factors like sexism, racism, and other systemic and social blockades, there is higher gross mortality in pregnancy and childbearing for African-American women. Women of African descent are three to four times more likely to die from childbirth complications and are three times more likely to have fibrosis than white women and develop them at a younger age. A plethora of chronic illnesses related to stress are more prevalent in African American women as a result of socioeconomic disadvantages and earlier onset of life stressors. Misdiagnosis of African-American women often leads to severe complications and increases the rates of preventable deaths. The substratum of this distressing disparity is the stereotypical ideology that leads some medical professionals to provide subpar services to women of color. This poster presentation will explore the roots of such disparities, the impact that they have on the African American community, and preventable measures to decrease the mortality rate associated with social injustices in healthcare.

**u or **g Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION VI – ANTHROPOLOGY

No 2020 Program

SECTION VII: STEM EDUCATION
Paper Session
Thursday Afternoon 2:00 – 4:40 pm
Arthur J. Bond Engineering Building, Room 103
Sarah Adkins, Presiding

1. 2:00**g **COGNITION AND THE 8th GRADE SCIENTIST: STRATEGIES THAT PROMOTE THINKING.** *Chris Taylor*, University of Alabama at Birmingham; Tanya Hyatt, Indian Springs School.

Here we describe methods that integrate potentially disruptive technology with a lecture format that promotes discussion, interaction, and the reinforcement of the instructor's intended narrative. The instructor was trained in previous employment to teach college students with traditional lectures. This method was perceived to inadequately engage students at the eighth grade level. PowerPoint presentations distracted students from the instructor's lecture and class pacing was disrupted. In response, we utilized pedagogical methods that promoted information retrieval, retention, and metacognitive analysis. Classes began with ten-minute warm-up quizzes. Each quiz consisted of three questions from the previous day, previous week, and the week before. This method promoted discussion and clarification of misunderstandings. The lectures also implemented retrieval methods wherein past information was used as a platform for discussion among students using a think-pair-share format. Note-taking was discouraged while the instructor was speaking, while active listening and question formulation was encouraged. The lectures were paused twice during each class to allow students to think about what they remembered from the instructor's lecture, record their thoughts, and discuss the material. Students were assigned exercises that promoted synthesis of all topics, deeper contemplation of the material, and exposed gaps in understanding. These methods allowed the instructor to still use PowerPoint presentations as a visual tool. Moreover, these methods encouraged active thought and memory retention, while discouraging the copying of material that was already available to the student.

2. 2:20**g **WHY DOES OUR WORK MATTER? CONNECTING MICROBIOLOGY LABORATORY CURRICULA TO NORTH BIRMINGHAM.** *Sarah Adkins*, University of Alabama at Birmingham; Brad Bennett, Samford University; Rob Akscyn, Jeff Morris, University of Alabama at Birmingham.

A critical facet of Course-based Undergraduate Research Experiences (CUREs) is student data being relevant to stakeholders beyond the classroom. However, despite CUREs becoming a common pedagogy in the reformed laboratory class, there is little known about how students understand the importance of their data contributing to community stakeholder needs. We surveyed students' (n=113) perceptions about civic engagement across three synchronous CUREs at different Birmingham universities that are all related to the same environmental pollution issue in North Birmingham, Alabama. The curriculum also had students report their data to each other through shared two-five-minute videos. We used the Tool for Interrelated Experimental Design, Civic Engagement Survey, Civic Attitudes about the Relevance of Science, and Persistence in the Sciences as pre and post-surveys, and additionally collected qualitative data through end of semester class-wide interviews (n=53). Across survey and interview data, we

found increases in students reporting that research could, in fact, help solve a problem in the community; however, this and other gains varied between course type. Students in the introductory course were more likely to report larger gains in understanding the process of science, and students in graduate-level courses were more likely to report skills gained and a greater understanding of the needs of stakeholders, particularly through the videos. The research and curriculum modules can be used by instructors assessing or implementing CUREs in order to increase connections between laboratory students and their community needs.

3. 2:40**u BUILDING A 3-D MODEL OF THE MARS DESERT RESEARCH STATION USING ADDITIVE MANUFACTURING *Amelia Claire McCain*, Anna Abernathy, Athens Renaissance School (ARS); J Wayne McCain, Athens State University.

This paper presents an overview of the development of a three-dimensional model of the Mars Desert Research Station (MDRS) using additive manufacturing (3D printing and CAD). The MDRS conducts high-fidelity, analog Mars mission simulations of a two-week duration as an integrated educational and research experience for space enthusiasts and students. Over 230 crews with more than 1,300 participants have been party to these mission simulations since its inception in 2001. In this research, a simple computer-aided design (CAD) software package was used to design a small-scale model of the MDRS that could be used within the Mission Operations and Communications Center (MOCC) facility for clarification of facility physical activities during simulations.

4. 3:00**u STANDUP OF A MISSION OPERATIONS & COMMUNICATIONS CENTER FOR THE MARS DESERT RESEARCH STATION. *Kimberly Graham*, Katherine Brewer, J Wayne McCain, Athens State University.

This paper addresses the development and standup of a Mission Operations and Communications Center (MOCC) for the Mars Society's Mars Desert Research Station (MDRS), physically located near Hanksville, Utah. The objective of the MDRS is to conduct high-fidelity, analog Mars mission simulations of a two-week duration as an integrated educational and research experience for space enthusiasts and students. Over 230 crews with more than 1,300 participants have been party to these mission simulations since its inception in 2001. Communications with this remote facility during the simulation is done primarily asynchronously using a HughesNet satellite internet link and a custom email protocol. Capsule Communicators (CapComs) are voluntary positions consisting of trained personnel scattered throughout the world. The goal of establishing the MOCC is to provide a central communication and support hub that can be online from the Central Time Zone and increase communication capabilities, while reducing the effects of world-wide time zone scattering of current volunteers. In addition, it will be the long-term goal to increase MDRS's communication capabilities to include synchronous voice, video, and data. The proposed architecture of the MOCC is presented herein.

5. 3:20 CAN PRESCHOOLERS DO FRACTIONS? YES, AND FINE MOTOR SKILLS PREDICT THEIR ABILITY. *John Shelley-Tremblay*, Lindsey Clark, University of South Alabama; Julie Cwikla, University of Southern Mississippi.

We investigated how preschool-aged children understand and solve fractional problems involving whole numbers and fractions using "equal sharing." Mathematical tasks were presented in two formats : paper and pencil format and in context as E-stories displayed

on a touchscreen. We also measured how fractional reasoning ability correlated with both fine motor skills by using a pegboard and usage of gestures during a counting task. Participants included fifty preschoolers ages four-to-five-years-old in two public schools from the United States. Children were tested individually inside the school. Mathematical tasks were developed to evaluate subjects' fractional reasoning ability. The mathematical questions were presented in either a paper and pencil format or as E-stories displayed on a touchscreen laptop. Children who received the paper and pencil version were presented with items, such as pictures on a sheet of paper, and were asked to split-up or share the items "evenly" and "fairly" amongst people or other objects. The E-stories included the same mathematical stories and directions as the paper and pencil version. Accuracy for the paper and pencil version was computed by dividing the total points possible by the total points achieved. For the E-stories, the child's number of attempts and the amount of time taken to complete each question determined accuracy. After the mathematical task, children completed a counting task where they were instructed to use their fingers and count the number of dots in a box on paper out loud. A behavioral analysis of gestures recorded their accuracy, synchrony, hand morphology, and whether or not subitizing occurred during the task. Lastly, children completed the Grooved Pegboard test to assess fine motor ability. This included two trials, once with their dominant hand and once with their non-dominant hand. We found that the performance on our mathematical measure significantly predicts fine motor ability as assessed by the Grooved Pegboard test. A stepwise linear regression positioned total score on the mathematical stories as the outcome variable and the independent variables were peg-board dominant hand time, non-dominant hand time, dominant hand drops, and non-dominant hand drops. The model shows that the number of non-dominant hand drops explains 25.8% of the variance of the outcome variable. The paper and pencil mathematical stories had a maximum score of seventy-six and a minimum score of eight with an average score of 40.36. Mean accuracies for the paper and pencil stories and the E-stories were compared with an independent samples T-test. E-stories yielded significantly more accuracy than the paper and pencil version. Preliminary analysis of gestures during a dot counting task indicates that gestural accuracy is associated with improved mathematical ability. Preliminary analyses suggest that embedding fractional concepts within a social context may be more beneficial to mathematical learning during the preschool years. These results also provide insight into the strength of the relationship between fine motor and cognitive development and are relevant in their support and extension of previous research, suggesting that these two functions display similar protracted-time courses during development.

6. 3:40 LEGACY SIMULATION OF HUMANS-TO-MARS, PROJECT ARES. *J Wayne McCain*, James Garrett Athens State University; Wallace Price, University of Alabama; Sally McClelland, Samuel R. Martin Auburn University; James E Young, Jacksonville State University.

While present-day simulations of human missions to Mars are high-fidelity and quite impressive (e.g., MDRS and HI-SEAS), a notable, sixteen-day simulated flight to Mars was conducted in the spring of 1969 by a group of more than thirty high school students from Anniston High School in Alabama! Acclaimed by then Director of the Marshall Space Flight Center, Dr. Werner Von Braun, in a congratulatory letter to the I crew, this activity took place between the first manned orbital mission to the moon, Apollo 8 in December of '68, and the Apollo 11 moon landing in July of '69. This paper

summarizes the project which was embraced by the high school administration and the community as a point-of-light in an otherwise time of darkness as nation-wide campus demonstrations against the Vietnam War and civil-rights unrest were commonplace. The Ares I mission, a coordinated, group science project might serve to inspire today's students to conduct similar, but updated research. Ares I is summarized in a recent Amazon paperback entitled, "Eight Days To Mars: A 16-Day Simulated Mission Barsoom- Ares 1" or in a Kindle edition that's free for Kindle Unlimited members. This little booklet is also being used in our "How to Create a Science Project" campaign.

7. 4:00**u DEVELOPMENT OF THE "HOW TO CREATE A SCIENCE PROJECT" PODCAST FOR STEM ENHANCEMENT. *Katherine Brewer, Kimberly Graham, Collin Rogers McCain, J Wayne McCain, Athens State University; Tracy Chastain, Athens City/County Schools.*

During the 2019 Alabama Academy of Science (AAS) annual meeting, members of the section "VII STEM Education" accepted the task of developing a series of podcasts to encourage students to further pursue submission of science research projects and/or posters to the Academy. This paper presents a summary of the efforts to develop and produce the first podcast in this series entitled "Steps In Creating a Science Project." Along with Mrs. Tracy Chastain, a highly qualified fourth-eighth grade science teacher, Dr. Wayne McCain produced and directed the podcast which is being aired on the Athens State University radio station kasuradio.net. In addition, the podcast is available on the AAS STEM Education Facebook Group page (<https://www.facebook.com/groups/1235671676444524>)(<https://anchor.fm/dr-j-wayne-mccain/episodes/Alabama-Academy-of-Science---Steps-In-Creating-A-Science-Project--1-e941vv/a-a12ceiq>.) It is expected that this first podcast on this specific topic will lead to additional podcasts that may be distributed to K-12 science students within the State. The actual podcast will be presented as well.

8. 4:20 LATE COLLEGE CAREER INTERVENTIONS: ENCOURAGING WOMEN TO ENTER COMPUTER SCIENCE THROUGH CROSS-DISCIPLINE PROGRAMS (A CASE STUDY). *Sara Cline, Athens State University.*

This paper presents a description of the motivations of a woman in her junior year at Athens State University to change her degree plan from biology to biology with bioinformatics option. Her experiences are presented as a case study that provides a potential pathway for moving women into the field of computer science late in their undergraduate careers. The implications of her motivations for switching fields are discussed, including the impact her experiences may have on informing future research and program design.

**u or **g Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION VII: STEM EDUCATION

Poster Session

Thursday

Arthur J. Bond Engineering Building, Auditorium

Authors Set-up: Begins at 7:30 am

Authors Present. 1:00 – 2:00 pm, Viewing and Judging

Sarah Adkins, Presiding

9. ****g** ASSESSMENT OF TEAMWORK SKILLS IN UNDERGRADUATE EDUCATION. *Elizabeth Huckaby*, Monica Mason, Norman Estes, Samantha Giordano-Mooga, University of Alabama at Birmingham.

Teamwork is an essential aspect of all careers and in no sector is this more pertinent than in healthcare. This study looks at a team-based learning (TBL) curriculum present in an undergraduate program geared towards pre-health students. TBL utilizes skills that should be practiced over time and built upon; thus, it is crucial to start these programs early in an undergrad's collegiate study. In this study, we hypothesized that students struggle to accurately rate team effectiveness using two previously validated tools: CATME and Team Value Rubric (TVR). A semi-structured interview was used to obtain qualitative data for comparison to the quantitative data provided by CATME, which was used to assign a grade, and TVR, which was not. During the interview process, students were asked targeted questions and were asked to provide a ranking for each member of the team. This pilot study shows that the results of CATME and TVR align, suggesting that grading incentives do not affect accuracy. Interviews addressed key insights into specific themes, such as communication, conflict, and relationships, that will be used to frame future project interviews. Our future goal is to conduct this study in a larger sample size of students. Understanding accurate representation of team rankings, as well as student ability to rate team effectiveness, will help educators target specific teamwork skills for improvement for undergraduate students and will prepare them for entrance into the healthcare workforce.

10. ****u** UNDERGRADUATE RESEARCH AND TRANSFERABLE SKILLS: A SCOPING REVIEW. *Marissa Brasher*, Cameron Pittenger, Jenna Bae, Samantha Giordano-Mooga, Christine Loyd, University of Alabama at Birmingham.

The purpose of college is to prepare individuals for entry into the workforce. These types of positions require extensive ability to assess situations, think critically, solve problems, work and lead teams, and communicate effectively, all while maintaining motivation and self-efficacy. Often there is limited time or lack of opportunity in classroom settings to build and retain these transferrable skills; thus, necessitating other outlets, such as research experiences. We have conducted a systematic review of the literature in order to assess the ability of undergraduate research experiences to facilitate the development of transferrable skills. Using relevant keywords, our librarian-collaborator conducted a systematic search in five literary databases amassing 20,834 abstract hits, our team currently has reviewed 12,893 abstracts with an ~8.7% acceptance rate. For sake of review efficiency, the research team is organized into a hierarchical structure consisting of faculty, graduate students, and undergraduate students from multiple institutions. The initial screening of the abstracts showed trends within the data relating to transferrable skill development through undergraduate research experiences. The most prevalent transferrable skills observed in the

data are communication, critical thinking/problem solving, and teamwork. Interestingly, the data also indicates that a majority of undergraduate research experiences are conducted via some form of course-based setting. Furthermore, while conducting this study, our research team identified a gap in the literature regarding what constitutes an undergraduate research experience. Lastly, an analysis of the selected literature will be conducted to further qualify and quantify the effects of undergraduate research experiences on the development of transferrable skills.

11. FERMENTATION FUN: A STRAIGHTFORWARD ACTIVE LEARNING EXERCISE THAT BLENDS FOOD SCIENCE, MICROBIOLOGY, MOLECULAR BIOLOGY, AND BIOINFORMATICS. *Brad Bennett*, Silvia Kinnebrew, Samford University; Shannon Carden, Magic City Ferments.

Kimchi is a traditional Korean condiment made of spicy fermented cabbage, and its origin dates back at least 2,000 years. Fermentation is the microbial anaerobic breakdown of primary metabolites, such as simple sugars, providing energy to the bacteria. For kimchi, fermentation is typically accomplished by lactic acid bacteria (LABs), with the process taking weeks to generate the secondary metabolites (by-products of fermentation) that enhance the flavors of this dish. The goal of this project was to isolate and identify LABs present in a locally made kimchi. Separate small batches of kimchi were allowed to ferment over the course of two weeks at two different temperatures: room temperature and 4°C. On days two, eight, and fourteen, ~15 g of kimchi was removed and processed into a homogenous mixture. The kimchi brine was filtered from the vegetable solids, brine dilutions were plated onto Lactobacilli MRS Agar plates that included a Bromophenol Blue (BPB) indicator dye, and the plates were incubated at 30°C for two days. At each time point and temperature, multiple colonies grew on the plates, some with differing shades of blue. We isolated genomic DNA from ten representative colonies and performed PCR using sixteen rRNA primers. Amplified PCR products were purified and sent for DNA sequencing. According to BLAST and the Ribosomal Database Project (RDP), most sequences returned matches to probiotic LAB genera commonly found in kimchi, such as *Leuconostoc*, *Lactobacillus*, and *Weissella*. This could be incorporated as a modest cost active learning module in an undergraduate biology course.

12. CAREER DEVELOPMENT ENHANCES TRANSFER STUDENT SUCCESS. *Betsy Dobbins*, Rita Malia Fincher, Samford University.

The transition from a two-year community college to a private four-year university can be especially challenging in STEM disciplines and requires intensive mentoring. We describe a low-cost, student-centered support system that we developed at Samford University to facilitate first-year transfer student success. Samford offers a one-credit Foundations class to freshmen and transfer students, with the aim of acclimating students to the campus and city, providing access to campus support and resources (e.g., writing center, career services), and building cohorts within incoming students. This freshman-oriented program lacked appeal and utility for transfer students. We created a custom Foundations course for first semester STEM transfer students, designed to enhance retention and student academic success by mentoring students through career skill-building. Within this goal-oriented approach, each student was encouraged to develop and articulate individual career and academic objectives, both immediate and long-term. We then scaffolded skill development and meetings with campus mentors that targeted off-campus interactions with career mentors that prepared students to apply for internships or research experiences the

following summer. During this career-development process, students built strong relationships with mentors and peers, established mentoring constellations across campus, cultivated local career networks, interacted with student support organizations on campus, created strong resumes, practiced application and interview skills, and received guided, active mentoring by program faculty. This program increased student retention and helped students secure paid summer placements that will contribute to their career development. This one-credit course is applicable to all four-year institutions that receive transfer students.

****u or **g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION VIII – ENVIRONMENTAL AND EARTH SCIENCES

Posters

Concurrent Poster Session with Section I – BIOLOGICAL SCIENCES

Thursday Afternoon

Arthur J. Bond Engineering Building – Auditorium

Authors Set-up: Begins at 12:00 pm

Authors Present: 3:00 pm– 5:00 pm

Brad Bennett, Presiding (Biological Sciences)

Malia Fincher, Presiding (Environmental and Earth Sciences)

1. **g THERMOREGULATORY GENE VARIATION IN THE EASTERN FENCE LIZARD (*SCeloporus undulatus*) IN RESPONSE TO SILVICULTURE TREATMENTS IN A SOUTHEASTERN HARDWOOD FOREST. *Thomas Haltigan*, Alabama A&M University; *Yong Wang*, Alabama A&M University; *William Sutton*, Tennessee State University; *Venkateswara Sripathi*, Alabama A&M University.

Understanding the impacts of forest management techniques on habitat and wildlife community composition is essential for long-term biological conservation. The life-history traits of ectothermic vertebrates, such as *Sceloporus undulatus*, are dependent on the thermal environment these organisms inhabit; thus, alteration due to anthropomorphic change may influence the expression of genes that are functionally associated with thermoregulation. As part of an ongoing research project evaluating the effects of prescribed fire and thinning regimes on herpetofaunal communities using a field experiment consisting of control impact and factorial complete block design from 2005 to 2018, herpetofauna were sampled throughout the active season which ranged from May to October each field year. A two-way analysis of variance (ANOVA) will be conducted to test treatment effect per x year on *S. undulatus* abundance. DNA was extracted from *S. undulatus* toe and tail clippings collected in 2017, 2018, and 2019 using the Qiagen DNeasy Kit. Primer pairs for five genes associated with thermoregulation and life-history were obtained from NCBI Primer-BLAST amplified via polymerase chain reaction (PCR). These genes will be sequenced and aligned with MUSCLE. Variation in gene sequences among populations will be interpreted using Principle Coordinated Analysis and visualized via heat map analysis in R. Correlation between variations in gene expression and variation in microclimate features among treatments will be analyzed with the HISAT2, StringTie, and Ballgown tools in R. My study will evaluate both *S. undulatus* community and genetic response to prescribed burning and thinning thirteen years after the initial implementation in the Bankhead National Forest (BNF), Alabama.

2. **u BACTERIAL COMMUNITY COMPOSITION OF BIOCHAR AMENDED SOIL. *Autumn Hill*, Elica Moss, Alabama A&M University.

Climate change is one of the most critical issues concerning the modern world. The recent practice of amending soil with biochar, a carbon-rich product derived from the pyrolysis of organic material at relatively low temperatures, has become a promising method to minimize atmospheric CO₂ emissions (carbon sequestration), mitigate global warming, improve plant productivity, and nutrient cycling. Biochar affects physiochemical processes and has the ability to alter microbial community composition. This study observed the predicted carbon sequestration potential of four soils amended with biochar (0 mg/h, 5mg/h, 12.5 mg/h, 30.02 mg/h). Our study reflects a shift in microbial community structure and diversity with added biochar. Specifically, the higher bacteria diversity and increase in copiotrophic bacteria

(Actinobacteria) and a decrease in oligotrophic bacteria (Acidobacteria) is in-line with the theory of enhanced copiotrophic bacteria and reduced oligotrophic bacteria contributing to an increase in CO₂ emissions. However, our study also showed that with increased biochar amendment, there was a decrease in copiotrophic (Proteobacteria, Gemmatimonadetes, and Firmicutes) bacteria, which would signal a decrease in CO₂ emissions. The results reflected here confirm that biochar does alter microbial communities, however, there is a contradiction in terms of whether this addition indicates the role of oligotrophic and copiotrophic bacteria in carbon sequestration and thus deems further review and analysis.

****u** or ****g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION IX: HEALTH SCIENCES
Paper Session
Thursday Morning, 9:00 am – 10:40 am
Arthur J. Bond Engineering Building, Room 120
Ronald N. Hunsinger, Presiding

2. 9:00 AM CURRENT DEVELOPMENTS IN THE USE OF ANIMAL MODELS IN HEALTH SCIENCES. *Warren Jones*, Samford University; *Rebecca Jones*, University of Alabama at Birmingham.

A significant number of animal species are used as embryological and physiological models in the health sciences. However, few of these important animal models are fed nutritionally complete diets before or during clinical studies. This review focuses on two representative species: the variegated sea urchin, *Lytechinus variegatus*, and the zebrafish, *Danio rerio*. We will review the development and refinement of prepared diets for these species, and will also discuss our current studies that focus on non-allometric growth metrics to determine dietary requirements.

3. 9:20 AM CADAVERIC DISSECTION IN THE EDUCATION OF HEALTH SCIENCE CLINICAL STUDENTS. *Mark Caulkins*, Nick Washmuth, Brad Cantley, Paul Harrelson, Kathleen Caulkins; Samford University.

For many years, cadaveric dissection has been used in the education and training of students in medicine. We present the rationale for performing and studying dissection of cadavers in the training of future clinicians and offer several interesting anomalies found in the cadavers dissected by students in the Samford University Cadaver Lab, and the UTEP Human Anatomy.

4. 9:40 AM . VIRTUAL DISSECTION: ALTERNATIVE TO CADAVERIC DISSECTION FOR A PREGNANT NURSE *Ronald N. Hunsinger*, Nicholas Washmuth, Terri Cahoon, Katrina Tuggle, Samford University.

5. Anatomy is a cornerstone of health-professional education. In order to obtain enough practice to successfully enter a medical career, deep, hands-on, interactive experience is vital for physicians, nurses, physical therapists, physician assistants, and other health professionals. Dating back more than 2500 years, the use of human cadavers has been the gold standard for such an experience. Using cadaveric dissections in anatomy education allows for various advantages: promotion of active and deep learning, preparation of the student for clinical practice, correlations of structure to pathology, exposure of students to death, and three-dimensional conceptualization of skeleton-muscular, innervation, vascularization, and visceral arrangements. It is a tactile form of learning that allows students to transfer didactic concepts learned in lectures into real, hands-on experiences. However, formaldehyde used in the preservation of cadavers can render the laboratory sessions a health risk. OSHA levels for formaldehyde exposure in gross anatomy laboratories has been set at 0.75 ppm TWA per 8 hrs. Formaldehyde is known to irritate the eyes, nose, throat, and skin, as well as

sensitize the respiratory system. In addition, it is a cancer hazard, especially for the nose, throat, and lungs. It is imperative that formaldehyde levels be monitored using a real-time monitor and that the ventilation system in the laboratory can ensure proper air exchange. However, a literature search indicates that pregnant students should avoid formaldehyde exposure in gross anatomy laboratories altogether, and that other means of laboratory experiences be made available to them. This case study compared exam results of a pregnant student in the Nurse Anesthetists Program at Samford University who completed all her dissections using an Anatomage Table with her 25-student cohorts completing their laboratory requirements in a gross-anatomy class using human cadavers. Within the limited parameters of a case study, the results confirm that significant knowledge gain can occur by utilizing the Anatomage Table for “dissection” just as much as it can occur with dissections on actual cadavers. From these studies, we can conclude that neither method is more or less effective—their effectiveness is dependent on faculty’s ability to teach adequately.10:00 AM

BREAST CANCER DIAGNOSTIC TECHNOLOGIES: TODAY AND TOMORROW. *Donna Cleveland*, University of South Alabama.

Since the earliest days of mammography, radiologists have recognized that the radiographic composition of the breast varies widely between individuals. The ACR BIRADS 5th edition breast composition categories are:

- A. The breasts are almost entirely fatty.
- B. There are scattered areas of fibroglandular density.
- C. The breasts are heterogeneously dense, which may obscure small masses.
- D. The breasts are extremely dense, which weakens the mammography’s sensitivity.

Breast composition is a function of x-ray attenuation, which is when breast tissue absorbs x-rays as they pass through the breast. the absorption of x-rays by tissue as they pass through the breast, Knowing this is vital because an appreciation of breast composition can “help indicate the relative possibility that a lesion could be obscured by normal tissue.” Put even more simply, not only does dense breast tissue reduce the sensitivity of screening mammography, it can also be an independent risk factor for breast cancer.

Breast tissue density is a radiological term that refers to the appearance of fibroglandular tissue on the mammographic image. It is the supportive structure of the breast and ductal system. Fatty tissue is virtually transparent to x-rays because it appears black on a mammogram, providing good contrast for cancers (which appear white on the mammogram); fibroglandular (r dense) tissue also appears white and therefore can disguise or mimic cancers. Dense tissue presents particular difficulty in that even a small region of high density can obscure a small cancer. An individual woman’s breast tissue density is simply the percentage of her breast that is composed of fibroglandular tissue; a percentage that will vary over her lifetime, increasing and decreasing during periods of childbearing and lactation, and generally decreasing with menopause. Other than age, the largest impacts on breast density in an individual is from changes in body mass index (BMI), hormone replacement therapy, and from tamoxifen or other aromatase inhibitors utilized as breast cancer prevention drugs. Breast

density has also been found to be an inherited condition.

Scientists have long recognized that breast cancers develop primarily in the lobular and ductal systems, and that it is also these systems that cause the mammographic image of a breast to appear dense. Although FFDM materially improved the sensitivity of screening patients with dense breast tissue over analog mammography, research continues to show that sensitivity remains low for patients with dense breast tissue.

Research concerning breast density has evolved to the acceptance that breast tissue density is considered an independent risk factor for cancer itself, rather than just confusing the interpretation of the mammogram. The understanding of high tissue density as a risk factor has reached the level of consensus, with the American Cancer Society (ACS) quantifying the relative risk of breast cancer due to extremely dense breast tissue (BIRADS D) density at 2.1 to 4.0 times the normal risk. Extremely dense breast tissue is ranked equivalent to having one first-degree relative with breast cancer and just behind a personal history of breast cancer or two to three first-degree relatives with premenopausal breast cancers.

The implications of breast density on causal risk continue to be discovered through ongoing lines of research. Breast density has been linked to risk for postmenopausal women sufficient to warn against the use of hormone therapy. Tissue density has been associated with risk of cancer in the contralateral breast for women who have previously been treated for ductal carcinoma in situ (DCIS), and density has been differentiated as a risk factor in cases of lobular involution. As breast density research continues, it is probable that the relationship between tissue density and the fundamental biology of breast cancer will be clarified. Mammography has long been considered the “gold standard” of breast imaging; it is the most accurate and cost-effective method of screening for breast cancer. Mammography has a sensitivity range of 75% to 90%, a specificity of 90% to 95%, and a proven record of decreasing breast cancer-related mortality rates. The combination of mammography screening examinations that find breast cancers in its early stages paired with advancements in treatment, has made it possible for 98% of breast cancers that are found early to be cured.

However, mammography is not perfect. It does not find all cancers. There are some types of cancers that cannot be visualized on a mammogram. Additionally, there is always the possibility of human error-- due to the nature of breast tissue and how it is imaged on a mammogram, it is possible for a cancer to be overlooked by the radiologist, or for a technologist to fail to pull the cancer onto the image. Because of these weaknesses, innovative technologies and methods are consistently being invented to aid radiologists and technologists in performing at an even higher degree of perfection.

This paper will discuss the varying technical modalities that are being researched and applied to patient imaging as an adjunctive study to the mammogram’s ability to obtain an accurate diagnosis.

***u or **g* Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION IX: HEALTH SCIENCES

Poster Session

Thursday Morning

Arthur J. Bond Engineering Building, Auditorium

Authors Set-up: Begins at 8:30 am

Authors Present: 11:00 am - 12:00 pm for Viewing and Judging

Ronald N. Hunsinger, Presiding

6. . ANATOMIC VARIANTS IN STUDENT CADAVERIC DISSECTION. *Mark Caulkins*, Nick Washmuth, Brad Cantley, Kathleen Caulkins, Samford University.

Cadaveric dissection has long been a part of the education and training of 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. Because of the cost of cadavers, many programs are increasingly using models, including holographic programs. However, one of the advantages of cadaveric dissection is the anomalies found in every cadaver. We present some of the interesting anomalies found in cadavers that were dissected at the Samford University Cadaver Lab and the UTEP Human Anatomy Teaching Laboratory.

7. **g. IMPACT OF A NURSE-LED IMPLEMENTATION OF A FALL PREVENTION TOOLKIT FOR OLDER ADULTS IN A MOBILE IPE COMMUNITY CLINIC: A PILOT STUDY. *Tiffani Chidume*, Auburn University.

Background and Objectives: Falls are costly and one of the most expensive medical conditions to treat. The implementation of fall prevention toolkits (FPTs), such as fall risk screenings and fall prevention education (FPE), have become increasingly important in reducing fall incidences. Nurses will have a greater role and responsibility to care for the aging population. The purpose of this project was to implement a FPT for adults age 65 and older that attended mobile IPE community clinics. Research Design and Methods: This project used a mixed-methods design. The Missouri Alliance for Home Care's ten-question survey and components of the CDC's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) FPE were used to assess and educate participants on fall risks and fall prevention. An initial baseline fall assessment and fall education score was obtained at the mobile IPE clinics. Follow-up assessments occurred one month after the initial assessment and compared to the initial fall assessment and fall education scores with an additional qualitative interview.

Results: In both fall risk assessment tools, lower scores indicated a lower fall risk; both fall risk assessment tools' means decreased over the one-month period. The paired t-tests results were clinically significant as evidenced by the decrease in falls.

Discussion and Implications: Future FPE implementation projects should consider providing resources the participants may need so there is no delay in increasing fall prevention and safety measures. The follow-up time period should also be increased to fortify FPE and keep participants engaged in fall prevention safety.

8. **u . UNPACKING THE C3 LOGIX AND SCAT 5 EVALUATION TOOLS: A LOOK AT HOW CONTACT AND NON-CONTACT SPORTS AFFECT NEURAL

COGNITION. *Greg Jenkins, Samantha Giordano-Mooga, University of Alabama at Birmingham.*

The lab engages in research on the utilization of ketone supplementation post-concussion, to benefit short and long-term function and recovery in adolescents in partnership with Children's Hospital of Alabama. Through the utilization of C3 Logix systems with embedded SCAT 5 concussion protocols, preliminary data was taken in the fall on: a rugby team, an ultimate frisbee team, and a group of non-athletes. The C3 Logix collects data on criteria such as: simple and choice reaction speeds, processing speeds, visual acuity, memory recall, and many other data points. The result of this was a data set with varying results from which many conclusions could be drawn. One of these was a correlation between contact versus non-contact sports and a differing in results within each measured criterion. Criteria such as reaction speed and memory recall varied noticeably between the sports, as well as for the non-athlete students. This difference in results from identical testing for non-contact, contact and no-sport students suggests a potential correlation between the type of sport and neural plasticity and brain function. Although the data is for a limited number of participants, there is enough to begin building a trend that can be compounded upon with the continued collection of this data type. These preliminary, baseline data sets will be incorporated into the larger ketone concussion project to provide another comparison set to establish the efficacy of ketone supplementation on sport-related concussions.

9. ****g IN-VITRO METABOLIC EVALUATIONS OF COMMERCIALY AVAILABLE CANNABIDIOL OIL ON THE METABOLISM OF COMMONLY PRESCRIBED CLASSES OF ANTIDEPRESSANT MEDICATIONS.** *Shelby Holley, Greg Gorman, Marshall Cates, Samford University.*

Purpose: The purpose of this study is to evaluate the effect of commercially available cannabidiol (CBD) oil on the metabolism of various antidepressant drugs. Antidepressant drugs utilize several cytochrome p450 enzyme metabolism pathways which may be affected by the concurrent use of CBD. Effects on drug metabolism may change the drug's efficacy, safety, and clinical therapeutic outcomes.

Methods: Fluoxetine, bupropion, and mirtazapine were tested in-vitro using human liver microsomes with 4 different concentrations of cannabidiol oil, and data was pulled at 3 time points over one hour. Using a mass spectrometer, these metabolic reactions were then analyzed.

Results: All comparisons calculated with bupropion were found to be statistically significant, showing that metabolism of bupropion is largely affected by the addition of CBD oil. Mirtazapine's data also shows that it has statically significant changes in metabolism between all concentrations of CBD oil, except between 10 μ M vs. 5 μ M. These two concentrations of CBD affect the metabolite production very similarly. Lastly, none of the fluoxetine reactions were shown to have statistically significant differences, exhibiting that CBD oil likely has minimal effects on the metabolism of fluoxetine.

Conclusion: This research provides data that can be beneficial for healthcare providers when determining monitoring, treatment, or use of antidepressant medications in a patient who uses CBD products. This evidence shows that high doses of CBD may inhibit the

metabolism of mirtazapine and bupropion, but that fluoxetine metabolism remains mostly unchanged by the addition of CBD.

10. ****u** . ESTROGEN RECEPTOR ALPHA SIGNALING PREVENTS AN INCREASED INFLAMMATORY RESPONSE BY ENCOURAGING DECREASED M1 MACROPHAGE DIFFERENTIATION. *James Boyett, Shannon Lynch, Samantha Giordano-Mooga, The University of Alabama at Birmingham.*

Estrogens, the driving force for female sex characteristics, have dichotomous concentrations throughout the female life cycle, which have been implicated as the driving force for differences in cardiovascular disease rates in pre- and post-menopausal females. To better understand these differences, and the role that estrogen plays in the damaging inflammation corresponding with cardiovascular disease, this lab has investigated the differences in monocyte differentiation into pro- or anti-inflammatory macrophages in both pre- and post-menopausal females with and without menopausal hormone therapy (MHT). Monocytes differentiate into M1 (pro-inflammatory) or M2 (anti-inflammatory) macrophages based on certain environmental stimuli and elicit desired responses. Differences in monocyte polarization were identified in post-menopausal females without MHT, when compared to pre-menopausal females, and said differences were found to be mitigated by the presence of MHT. When investigating the mechanism of estrogen-based differentiation utilizing ER α -KO and ER β -KO mice, it was found that the presence of mitochondria was significantly reduced in ER α -KO mice. These findings suggest a mechanism for monocyte differentiation leading to potentially decreased expression of M1 macrophages in the presence of ER α activation. Better understanding the role of estrogen signaling in inflammation and inflammatory responses will help to better understand the differences in disease incidence in pre- and post-menopausal women.

****u or **g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION X. BIOETHICS AND HISTORY & PHILOSOPHY OF SCIENCE

Paper Session I

Thursday Morning, 8:30 am – 12:00 pm

Arthur J. Bond Engineering Building, Room 101

Clark Lundell, Presiding

1. 9:00 PET: POLYETHYLENE TEREPHTHALATE; THE UBIQUITOUS 500 MILILITER WATER BOTTLE. *Clark Lundell, Auburn University.*

In the USA, 50 pounds of PET plastic (water bottles and other food packaging) pass through 125 million households each year, totaling 6.25 billion pounds of PET per year. In the USA, 30% of PET produced each year is recycled, while the world recycles less than 10% of PET production. .

PET is associated with single-use plastic that is used for a few minutes in its life cycle and then discarded. It takes 77 million years to make the fossil fuels from which conventional PET is produced and thirty minutes to actively use and discard this material as a single-use water bottle.

A PET bottle in a landfill takes 500 years to decompose. In the ocean, that same bottle breaks down into microplastics that also take 500 years. Microplastics are consumed by organisms as part of a food chain, which includes us. (Decomposition rates are estimates because PET material was only first introduced sixty years ago.)

Since 2009, Coca-Cola has distributed more than 35 billion PET bottles worldwide. A small part of this production is plant-bottle packaging, which converts sugars in plants into ingredients that can make up 30% of recyclable PET plastic. It is possible to produce a 100% plant-based PET bottle, but the cost is high.

Coca-Cola, PepsiCo, and Dr. Pepper are launching an “Every Bottle Back” initiative to keep bottles in recycling bins instead of oceans and landfills. World-wide recycling facilities are facing mounting challenges because China stopped buying two-thirds of the world’s recyclable plastic in 2018.

2. 9:15 LIVING WELL WITH TWENTY-FIRST CENTURY TRANSFORMATIVE TECHNOLOGIES. *Jim Bradley, Auburn University.*

Several twenty-first century technologies raise ethical issues that are not easily resolvable because they have moral systems that are commonly applied to other ethical problems. We are familiar with rule-based moral systems like utilitarianism (e.g. do the best for the most persons), Kant’s deontological ethics (e.g. do not lie because it is illogical to will that everyone lie all the time), and religion-based moral systems (e.g. treat others as you would be treated). One or another of these moral systems may be useful in day-to-day personal interactions, but they are not adequate for issues, such as personhood, human dignity, and human rights, raised by human reproductive cloning, embryonic stem cell, artificial intelligence, bio-chimera, brain organoid, and other modern technologies. A moral system based on teaching and nurturing certain virtues may be the best approach to making wise decisions and living well with these twenty-first century technologies.

3. 9:30 ETHICS OF CROSS-DISCIPLINARY STUDIO CRITIQUE TECHNIQUE: TWO ASSISTANT DESIGN PROFESSOR'S PERSPECTIVES. *Benjamin Bush, Anna Ruth Gatlin, Auburn University.*

Why is conducting an in-studio design critique mentally draining and ethically difficult? Because generating actionable, focused feedback is difficult, especially when faced with the ethics of delivering consistent critique across a diverse cohort.

There are three components to a high-quality design critique: analyzation, processing, and reciprocal communication. A design professor, faced with a classroom of 12-20 students who need personalized critique, must analyze the students' work and simultaneously construct mental feedback that is delivered with reciprocal communication. The professor must choose the most appropriate way to deliver feedback that addresses the design brief and accommodates each student's learning style that builds on current understanding of design and considers preexisting feedback. This process is repeated, on average, every ten minutes for the next three hours, sometimes twice a day.

Each discipline is different, but the underlying ethics of critique remain the same: addressing inequities among a spectrum of students and meeting those inequalities where they help students achieve the goals of the design brief. Social class, privilege, and other factors should not affect a student's "voice" and their ability to produce excellent design work. Although, questions inevitably arise: Is it ethical to spend more time with a particular student, at the expense of time with other, more privileged students? Is it more ethical to give each student an equitable amount of time regardless of their actual need? This presentation explores the ethics of studio critique through a lens of critical theory and the lived experiences of two cross-disciplinary assistant professors.

4. 9:45 SEEING THE WORLD THROUGH A CLOUDED LENS: ABSTRACTION AND FUZZY VISION AS A DESIGN TOOL FOR CREATIVE PROBLEM SOLVING. *Brian LaHaie, University of Georgia; Clark Lundell, Auburn University.*

Ever see too clearly? Ever focus so intently on something that you can't see the bigger picture? We rarely get accused of thinking too clearly; yet, it is often our ability to abstract our concrete thinking and to soften our senses that ultimately lead to a higher order of creativity and problem solving. Not being able to see the forest from the trees is not a vision problem—it is a distance problem. Stepping back from the trees gives us the distance and perspective needed to see a more comprehensive picture.

This presentation explores the general ideas of abstraction as a means to achieving higher orders of thinking, relative to the arts and sciences. It demonstrates how distance can eliminate distracting details, thereby allowing fuzzy vision to clarify one's solutions. Social psychology has named this relationship between distance and abstraction as "construal level theory." The author explains the theory and uses it to demonstrate strategies for creative problem solving in the fine, applied, creative design, and other disciplines.

5. 10:00 **u TECHNOLOGY DESIGN: THE SCIENCE OF ART. *Evanthi Hettiaratchi*, Auburn University.

The word “technology” in today’s language conjures up the image of a computer or similar device and implies that a device is a tool, usually one that helps us gain knowledge or convenience. This characterization of “technology” as a tool makes sense; after all, the technological advances in our history include the invention of the wheel, writing, and weapons, all of which are fundamental tools. However, even though we often view technology of the past and the present as things that are simply meant to help accomplish a goal, the word itself carries the Greek root *tekhnē* meaning “art or craft” combined with the common “-logy,” a suffix often translated as “the science of” something. Thus, technology is the science of art, and what better way to describe design? Perhaps, this is why today’s tech companies produce such good examples of designed objects. For example, Google Chromecast is a device that allows the user to “cast” what is streaming on one device (phone, laptop, etc.) to the screen of the TV to which the Chromecast is connected. It basically makes the process of connecting a computer to a TV, via HDMI cable, a wireless affair. The Chromecast is small, hidden behind the TV screen, so why does it need to be modern, sleek, and streamlined like the wire it replaces? It doesn’t, but Google makes it so because the elegant design enhances the user experience. This elegant design is the whole point of design: making a tool beautiful.

6. 10:15 **u Form and Function FORM AND FUNCTION. *Leah Marcus*, Auburn University.

The corpus callosum, a thick layer of nerve fibers, connects the two sides of the brain. It provides a critical pathway of communication between the brain’s right and left hemispheres. Likewise, objects that are designed to accommodate functional utility while also upholding aesthetic values foster greater productivity for mankind. Just as the brain would lack the ability to achieve a higher level of function without the corpus callosum, humans would lack the ability to achieve more effortless day-to-day function without designed objects. Merging utility and artistic value, designed objects exhibit a superior combination of function and beauty, compared to engineered or artful objects alone. For example, an everyday object, like a pair of sunglasses, is designed to provide protection from the sun while simultaneously adding a level of aesthetic significance, perfectly linking fashion and functionality. Objects like these are valuable tools, defined by their purpose of performance and style.

7. 10:30 **u HOLISTIC THINKING IN ARTFUL OBJECTS. *Jamie Clark*, Auburn University.

Artful objects are created with the primary intention of evoking emotion. They are usually visually appealing or trigger a positive memory. Looking at an artful object for the first time may leave someone feeling happy or satisfied. For example, I’m in a store and see a beautiful bracelet with a sea turtle charm. It reminds me of my summers in Florida when I did conservation work by guarding sea turtle eggs and watching the hatched babies make their first contact with the

ocean. Now, I feel happy, nostalgic, or fulfilled. Artful objects are associated largely with the right brain. The right brain is creative and connected to arts, imagination, and most importantly, in this case, holistic thinking.

Holistic thinking is derived from Holism. Holism is the idea that systems should be seen as wholes rather than a collection of parts; for example, a human heart serves no purpose outside of a body and is interdependent on other organs. Holism is a term found in a range of subjects, such as science, sociology, economics, and philosophy. Its context determines whether it'll be associated with the right or left side of the brain. Holistic thinkers are almost always subjective and are more right brain oriented. Holistic thinking is the opposite of analytical thinking, so holistic thinkers don't give much attention to detail. They explore the idea of things being part of a complex whole and are always looking at the bigger picture. Because of this mentality, they may experience less stress as they attempt to reach their long-term, "big picture" goals. When something doesn't go as planned, a lot of people like to say something along the lines of "everything happens for a reason," which is holistic thinking. People that say that phrase are implying that whatever event or inconvenience they just experienced is relevant to their bigger picture whether it be a long-term goal or just life.

In my first example, the "big picture" or "complex whole" includes the charm bracelet, the memories it evokes, and all the emotions it makes me feel. Without the bracelet, I can not remember that specific memory, and without the memory, I can not feel any of the positive emotions mentioned. Each thing is dependent on the other which is what makes it a whole or a system. Artful objects are associated with the right brain, specifically holistic thinking, because they are created with the intention of triggering an emotional response. Most objects are also created due to an emotional response in their creators. Paul Gauguin's *Spirit of the Dead Watching* was inspired by Edouard Manet's *Olympia*, and Edouard Manet's *Olympia* was inspired by Titan's *Venus of Urbino*. Without one, we may not have the others. Holistic thinking is everywhere—there's no telling how many artful objects exist because of it, and most people don't even realize it.

8. 10:45 **u COFFEE MUG DESIGN. *Alyssa Hatcher*, Auburn University.

For me, drinking coffee in the morning is more than just a way to wake up. It's a ritual, something I do each day that allows me to just sit in the quiet of the morning and mentally prepare myself for the day ahead. As a coffee enthusiast, I also have a bit of a passion for collecting mugs. It wasn't until I purchased a mug for this assignment, however, that I really started to think critically about mugs as designed objects. The purchased mug in question seemed more like an engineered object at first glance, a simple, off-white vessel used to hold caffeinated beverages. Upon closer inspection, however, I started to notice artful little details and subtle changes in the shape of the mug that transformed it into the form of an elephant. It was then that this mug became more than a practical object. Suddenly, it had an artful value that an engineered object just couldn't have. It became the middle ground between an object made solely for practical reasons and one made for its intrinsic artful value. In a similar way, the corpus callosum is used to both design and enjoy the design of this mug, so the corpus callosum, is, quite literally, the middle ground between the analytical (left) and intuitive (right) sides of the

mind. The corpus callosum sends signals from each side of the brain to the other side, allowing someone to holistically experience the design of a mug.

9. 11:00 **u THE DUALITY OF A MERE PEN. *Jordan Mercure*, Auburn University.

What is a pen? A hunk of plastic that can transfer ink to paper? A gateway to dreams and the imagination to be transferred to thousands? Often pens are designed to simply transfer ink to the papers, and yet this pen, a Pilot Razor Point, seems to evoke beauty in its curves, simplicity, and its retrospective packaging design. What sets this pen's nature of form and function apart from a bulk order pen that lacks such beauty? In function, this pen is designed to draw sharp lines quickly that dry fast and in high detail. Unlike a ballpoint pen, this is a marker-based setup that is built to override the bleeding effect that can be caused by traditional rolling ink-based pens. This functional pen evokes a beautiful efficiency inside its functionality that exemplifies it as a writing utensil. The art design is simple, but it can also evoke an impression of effectiveness with minimalistic beauty. The sharp angles on the lettering, as well as its metallic coloring, speak volumes to the fine details this pen can etch as well as to sensationalize its quality. The rounded yellow tip makes it identifiable like a signature to any who would recognize it in a cup or from a distance. The seemingly bleak gray exterior, at closer scrutiny, even contains metallic flecks giving it more unique qualities and thus, reinforcing its minimalistic beauty. The box uses this established minimalistic efficiency and reinforces the idea of grandeur in utilization of retrospective advertising to show its lasting cultural effect, the quality, and even using the red and white to snag attention. Yet with its adherence to a classic packaging style, it lends extravagance to such details without overwhelming the consumer who is looking for a quality product. Overall, this Pilot Razor Point pen exemplifies the idea of union between engineered and artistic measures, encapsulating the proper design that can stimulate this idea of harmony between both sides of the human mind.

10. 11:15 **u THE LEFT HEMISPHERE AND THE LEAD HOLDER. *Julia Whitt*, Auburn University.

The human brain is an intricate system of connections and traits that influence our everyday actions. The different hemispheres of the brain, the left and right, can also be related to how and what humans create and for what purpose. These two sections of the brain, though seemingly opposite, are connected by more than just the corpus callosum, which mediates and transfers information between the two sides. As a pre-architecture student, I spend most of my time creating and therefore, am going to explore the connection between the left hemisphere and my engineered object, and how they help me create which is a right brain characteristic.

An engineered object is designed to be purely functional with no attention paid to aesthetic. As a result, I choose a lead holder refill, a plastic tube with lead sticks inside, with no ornamentation on the package. This engineered object is intriguing because it may be completely utilitarian, but it is used to make something meaningful, which is a characteristic typically associated with the right brain. In contrast to the right, the left hemisphere is analytical, logical, and controls the

right side's motor skills, including writing and drawing. Therefore, the left hemisphere is mostly enacted to create this engineered object, but it is crucial in designing something the right brain will appreciate and identify with.

When using my engineered object in my major, I am using a left brain designed object and my left brain in order to draft because it requires logic; I am also using my right-sided motor skills because I am right-handed. Only after using the left hemisphere is the information translated through the corpus callosum into the right hemisphere, which assists in assessing artistically and emotionally what I have created. Therefore, the stereotype that the left brain and right brain are completely separate and have drastically separate traits is false because they are in fact complimentary: one cannot perform without the other, as seen in how they are connected through the creation and performance of my engineered object. Therefore, my lead holder refill is crucial in designing something the right brain will appreciate and identify with.

****u or **g** Denotes presentation entered in student competition as an undergraduate or graduate student, respectively.

SECTION X. BIOETHICS AND HISTORY & PHILOSOPHY OF SCIENCE

Paper Session II

Thursday Afternoon, 1:00 – 3:00 pm

Arthur J. Bond Engineering Building, Room 101

Clark Lundell, Presiding

11. 1:00 ****u** SCENTED SOAP PETALS: A FLORAL BOQUET. *Anna Leach*, Auburn University.

Designed objects take the best of what each brain hemisphere has to offer, combining the left brain's utility with the right brain's appeal to aesthetic value and emotion, in order to create objects (both large and small) that fulfill their purpose with an element of spectacle that is alluring to the consumer. A designed object embodies the corpus callosum by appealing to both hemispheres of the brain. The appearance and fragrance of the scented rose petal soap makes it one such object that targets the callosum due to its major role in transferring and processing sensory information. Soap was originally considered an engineered object meant for cleansing the body, but since its invention, designers have continually improved upon it. That process led to products like scented soaps. Instead of simply creating a bar of soap, the designers of this product wanted the consumer to feel pampered and special as they used it. Soap was carefully molded into the likeness of a rose and infused with its scent. The rose's association with love and beauty subconsciously fills the consumers' mind whenever they see or smell one. Finally, its packaging reinforces these ideas. Metallic bands catch the light, drawing in the eye; and its clear front and soft, yellow sides allow the

meticulously crafted petals to be fully seen and admired. The name of the company is Body Luxuries, which is the exact feeling they wish for the consumer to desire.

12. 1:15

**u GLASS BLOWN ORNAMENT. *Lilly Echeverri, Auburn University*

An artistic object is a designed object meant to evoke emotions in a personal or general manner, but it could also be made simply for aesthetic reasons. In simpler words, people enjoy artistic items because they are either pretty or the object means something to them, or even better, the objects are both pretty and sentimental. The object I chose is both to me. It is a hand-blown glass ornament. The reason I believe this is an artistic object is because artistic objects can have a lot of value placed on them, and handmade glass is becoming more and more valuable everyday with the possible lack of glass materials in the future. The actual act of making glass by hand uses the right hemisphere of your brain because glass making involves the abilities to see and produce a 3D object all in one go by heating, blowing, shaping and repeating until the artist is happy with the outcome. This is a skill not many have unless they are right-brain dominant, or it can be more difficult to envision what one is trying to make since it starts off as almost a sort of fiery blob before they mold it. Because it is difficult and not a common trade, there is even more value placed on handmade glass. The object I brought in is from the J&M Bookstore in their local market section made by a woman named Laura Bronson. The reason glass ornaments mean so much to me is because they make me think of my mom. Last summer (the summer before my first semester of college and being away) we watched the Netflix series called *Blown Away*. We fell in love with the act of glassblowing. I have a huge appreciation for that art form, and I hope to work with it one day for my own artistic enjoyment as a creative outlet while also getting a chance to use my right brain hemisphere.

13. 1:30

**u THERMOMETER. *William Rath, Auburn University.*

The left side of the brain helps us think about many things; mathematics, writing, analytical, logical, and reasoning skills all come from thinking. The left side of the brain is crucial to us. While the right side of the brain gives us creativity, the left side of our brain helps us with things like academics. The left side of our brain is so important to us because it helps carry us on our career paths. Like the left side of our brain, thermometers are essential too. A thermometer is an engineered object that helps us figure out what our body temperature is. This is important because we need to know whether or not we are sick which can save our lives. A thermometer is an engineered object because it consists of movement and rotation. When a thermometer needs new batteries, one simply slides the back of the thermometer up, and the back comes off. Once the batteries are in, all one has to do is slide it back on. A thermometer, like the left side of our brain, thinks on its own. All it needs is for us to place it in our mouth, and it will magically come up with the temperature. A thermometer, like the left side of our brain, has skills that are extremely crucial to us. A thermometer has many similarities with the left side of our brain, and that is why it is fascinating.

14. 1:45 **u OTTO THE OTTER. *Elizabeth Lowman*, Clark Lundell, Auburn University.

The holidays are always the time when parents are most vulnerable to the advanced psychology of marketing strategies. My dad is no exception. Let me elaborate. For Christmas 2017, I was given Otto the Otter. Otto is an otter figurine that doubles as a tape dispenser. Otto is the perfect example of a designed object. What sets a designed object apart from other objects is that it incorporates both the form of an artful object and the function of an engineered object. The form and function of this object resonates in both parts of a human's brain. The right side, which controls creativity, admires the realistic depiction of the otter shape; and the left side, which controls logic, admires that it is a useful object in an office or work setting. In addition to the right side and the left side being activated, the corpus callosum is also activated by this object because it controls movement between the two sides. To seal the deal, Otto came in a yellow box that said, "Happiness, optimism, a grateful daughter." I can see why my dad had to buy this object for his daughter when I take into consideration that the three parts of his brain were drawn to this unique object and its packaging. Well, luckily for my dad, my brain had the same reaction his did to the object. I am grateful that Otto is my tape dispenser.

15. 2:00 **u SMALL DIFFERENCES MAKE A LARGE IMPACT. *Morgan Slone*, Clark Lundell, Auburn University.

Imagine two seemingly identical lemon squeezers: one bright yellow with ridges mimicking the inside of a lemon and holes shaped like lemon seeds, and one metal without ridges or seed-shaped holes. The two squeezers are the same price, so a decent percentage of people would opt for the first one because of greater appeal. That is what engineered objects, like the metal squeezer, lack: aesthetic appeal. Engineered objects pay little attention to aesthetics because design elements and principles were not taken into consideration. In this case, there was no appeal of color, which is a quintessential design element; therefore, the metal squeezer was left appearing plain. Color is perceived by most literate adults in the left-brain, which is the dominant side in decision making. According to Satyendra Singh, about 62-90% of assessments are based on color alone. Additionally, the concept of perceived appropriateness plays a crucial role in a product is purchased. This argument is based on whether the colors of a brand logo "fits" that brand, according to a study by Cardiff Business School, but it can be applied to any object's color. Therefore, this lack of attention to psychological factors could hinder the profitability of the metal squeezer.

Engineered objects can also lack usability because they are not as connected with the human interface. The two lemon squeezers may not appear different, but the results of the one with ridges are better than the one without. The first lemon squeezer provides purely functional use with little regard to usability.

16. 2:15 **u RAINING LOTUS: AN ARTFUL OBJECT. *Logan French*, Clark Lundell, Auburn University.

What makes an object art? According to Socrates' in *The Republic* by Plato, arts are just a form of copying; undermines the differences in media, and an artist

merely reproduces forms mirrored from nature. In contrast to Socrates' left-brain logic, Aristotle's holistic thinking of the right side of the brain argued that mimetic arts are skillful renderings that emphasize the differences in media because they are important to understanding art. Tolstoy's critical "Theory of Beauty and Taste", the modern approach to the question "What is Art?" answers that: beauty is subjective: there is no one definition of art; and art promotes class inequality. He believes that art infects the audience with emotion. Art communicates in a unique way that is essential to human life. When discussing art, the word "aesthetics" is typically brought up. According to another philosopher named Berys Gaut, the definition of aesthetics includes moral evaluations. In art, aesthetics should be mentioned broadly because in the narrow sense, it only concerns beauty. The object that I chose, to represent an artful object, is a plastic, plug-in, mini water fountain shaped like a lotus. The fountain was designed to allow the customer to enjoy the relaxing sounds of water in his or her home. This is an artful object because it was created to mimic the memory and sound of running water with an aesthetic image of a lotus flower.

17. 2:30 **u SORORITY BADGE: MORE THAN JUST A PRETTY BADGE. *Chloe Cory*, Auburn University.

When people think of sororities, they probably think of southern girls, extravagant houses, and parties. These assumptions do not encompass all Greek life, just a part. Being assigned to write about an artful object, I thought about the definition. The item is supposed to evoke emotion, memory, or be aesthetically pleasing; and my sorority badge does just that. When I see my badge, I think of when I got initiated, all the symbolism that went into that ritualistic ceremony, and how much it meant to me. Now when I wear it, I get to show pride in my sorority and Greek life as a whole. This applies to how the right brain works. The right brain is in charge of artistic thoughts and the way people do things. This is best said by those who are more rightbrain inclined that see the whole picture before the small details. This ties in directly with my badge. When someone sees it, they can tell that I am in Greek life; but to know which sorority I am in, they need to pay attention to its individual characteristics.

18. 2:45 **u LEFT BRAIN, RIGHT BRAIN... FELLOWS. *Tanner Harden*, Auburn University.

Designed objects develop as a result of the necessity of functionality mixed with the desire for beauty. When humans interact with an object, they are experiencing it with both sides of their brain. The left hemisphere focuses on the practical nature of the object; how it works; what it does; what it is called; and how to use it. The right hemisphere appreciates designed objects for more abstract reasons. It is the side of the brain that houses imagination and creativity; and it appreciates art. The corpus callosum lies in the middle of the two hemispheres and acts as a connector, which allows information to pass between the two sides of the brain. The Fellow Stagg EKG Electric Kettle is a prime example of a designed object. The designers at Fellow Stagg strive to create the most beautiful, purposeful products: "Simple Aesthetic. Powerful Design." They do not compromise functionality for aesthetic beauty; they integrate the two. The body is minimal and

sleek to be like art; but it is also optimized for smooth and precise pouring. The base also appears simple, to accompany the sophisticated look of the kettle, but it is loaded with features; it controls the temperature, has a built-in timer, and can hold a desired temperature for up to an hour. The Fellow Stagg EKG is a successful product because it is a designed object, made with creativity, research, and intention. Maximized for efficiency and beauty, it appeals to both sides of the human brain. Combining practicality and delight, the designers carefully considered the most useful functions and integrated them into a stunning, minimal casing.

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SECTION X. BIOETHICS AND HISTORY & PHILOSOPHY OF SCIENCE

Poster Session

Thursday Afternoon

Arthur J. Bond Engineering Building, Room 101

Authors Set-up: Begins at 3:00 pm

Authors Present 3:15 – 4:00 pm, viewing and judging

James Bradley, Presiding

19. **BIOETHICAL ISSUES IMPLICATED IN GEROSCIENCE RESEARCH.** *Shuntele Burns*, Alabama State University.

The field of Geroscience has the potential to extend human life beyond its current limits. However, prolonging life span raises ethical issues that should be of concern not only to the scientific and medical communities but also to the global community in general. As humans age, they are more susceptible to certain diseases. Geroscience focuses on the age-based biological processes, seeking to target the molecular and cellular progressions that lead to age-related illnesses. These include genomic instability, telomere attrition, and cell senescence; and researchers are currently developing technologies, therapies, and drugs to manipulate some of these aging hallmarks, thereby postponing some diseases. If the onset of disease is delayed, life span will likely increase, but these manipulations and the resulting longer life span could be problematic. The long-term side effects of anti-aging interventions are unknown. Even if these procedures are found to be safe, a sharp rise in the elderly demographic could exacerbate population problems, increase health care costs, and unfairly burden the young and middle-aged. Furthermore, given the inequalities within and among societies and countries and the fact that life-extending interventions will not be equally available to all, is it ethical for researchers to focus on expanding life expectancy for those who already live longer, thereby increasing the disparities between rich and poor individuals and societies? Scientific efforts that may result in increased human life span beyond practical limits require thoughtful consideration of the ethical issues surrounding these pursuits.

20. **TYPOGRAPHIC READABILITY INDEX.** *Wei Wang*, Auburn University.

Readability is defined as the ease with which a reader can understand a written text. Low color contrast and small type (LCCST) on print materials have the potential to cause issues in readability, comprehension, and communication among consumers, especially in those with vision impairment. Often, graphic designers fail to keep these audiences and aspects in mind when creating designs due to modern design practices, aesthetics, and education. We surveyed over one hundred U.S. consumers and asked the participants to rate the readability of a variety of print materials one at a time, on a scale of 1 to 5, from “Very Easy to Read” to “Extremely Difficult or Impossible to Read”. Through data analysis, we discovered that the Typographic Readability Index (TRI) is a reliable measurement used by designers to predict the level of readability in print materials. With consideration of font size, font weight, font proportion, letter spacing and color contrast ratio as its main factors, the TRI can be calculated and used as a reliable predictor on how readable the text will be for the general population.

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GORGAS SCHOLARSHIP COMPETITION

Sci-Mix Session

Arthur J. Bond Engineering Building, Auditorium

Thursday Evening, 5:30 pm–6:45 pm

Ellen Buckner, Presiding

1. **EFFECTIVENESS OF HOME REMEDIES (APPLE CIDER VINEGAR AND NATURAL YOGURT) AT CONTROLLING *CANDIDIASIS* (FUNGAL INFECTION).** *Addison Allred*, Murphy High School, [Teacher-sponsor: Julie Prerost].

Rather than going through the trouble of seeing a doctor, many people have recently been turning to different home remedies in an attempt to control their yeast infections. I have decided to design experiments to determine which home remedy, apple cider vinegar or natural yogurt, is most effective at curing yeast infections. Yeast infections are due to an overgrowth of *C. albicans* or the penetration of the fungus into deeper vaginal cell layers. Alcohol fermentation is a process in which microorganisms, such as yeast, convert simple sugars into ethanol. The higher the rate of fermentation, the more yeast is present. The alternative hypothesis is that apple cider vinegar will be most effective at decreasing the rate of alcohol fermentation. I tested this hypothesis by conducting experiments in which I measured the carbon dioxide output of fermenting yeast cells. Carbon dioxide is directly correlated to the amount of ethanol produced and is a good indicator of the rate of fermentation. I added the two home remedies to the experiments and compared their carbon dioxide production, which determines the effect they have on the rate of fermentation. My results supported the alternative hypothesis. Apple cider vinegar proved to be most effective at decreasing the rate of alcohol fermentation. Thus, I concluded that apple cider vinegar is more effective than natural yogurt at controlling yeast infections.

2. **ACCESSING DIVERSITY IN GASTROENTEROLOGY AND GI SURGERY USING ARTIFICIAL INTELLIGENCE.** *Tosin Badewa*, Alabama School of Fine Arts (Teacher-sponsor: Rebecca Thrash).

The United States population is becoming more racially and ethnically diverse. Research supports that cultural diversity within organizations increases teams' performances, yet this theory has not been explored in the field of surgery. Furthermore, patients often prefer that their care providers mirror their own race and ethnicity. We hypothesize that there is a positive correlation between greater racial, ethnic, and gender diversity among gastroenterology and gastrointestinal (GI) surgery faculty and exceptional hospital outcomes. The U.S. News Best Hospitals by Specialty rankings score departments using data based on measurable outcomes like risk-adjusted mortality. We utilized these rankings to categorize gastroenterology and GI surgery departments into two groups: 1–50 and 51–100. Hospital websites of the top and bottom 50 were compared to determine if racial diversity and inclusion were highlighted in each group's core values and/or mission statements. Betaface (Betaface.com) artificial intelligence software deciphered the race, ethnicity, and gender of the physicians using facial analysis of photos taken from the hospitals' websites. We then ran the independent samples t-test to determine if there was a difference in the rankings of departments with a more non-white, underrepresented minority and female faculty. Finally, we used U.S. census data to determine if the racial and ethnic makeup of the populations served by these hospitals matched the demographics of the physicians. Hospitals with

gastroenterology and GI surgery departments in the top 50 were more likely to mention diversity on their websites compared to those that ranked from 51–100 (82% vs. 64%; $p = 0.04$). The top 50 hospitals also had a statistically higher percentage of underrepresented minority physicians (7.01% vs. 4.04%; $p < 0.001$). In the 31 states where the hospitals were located, there were more African Americans (13% vs. 3%; $p < 0.001$) and Hispanics (12% vs. 2%; $p < 0.001$) in the population compared to the faculty.

3. GRAIN STRUCTURE ANALYSIS OF ZnSe AND Cr:ZnSe POLYCRYSTALS FOR APPLICATIONS IN RANDOM QUASI-PHASE-MATCHING AND LASING IN THE MID-IR SPECTRAL REGION. *Eesha Banerjee*, Alabama School of Fine Arts (Teacher-sponsor: Rebecca Thrash).

Technologies using random quasi-phase-matching and thermal diffusion of dopants for mid-IR lasing are dependent on the grain structures of the polycrystals used, particularly the size and orientation of the grains. With the exception of expensive technology such as EBSD, these structures have been analyzed by manually using the line-intercept method to estimate the mean grain width. Existing imaging, image processing, and image analysis technologies can be utilized to provide a more affordable, in-depth grain structure analysis for lasing applications. In this research, preliminary experiments have been conducted for the development of such a process. The best combination of imaging, processing, and analysis obtained so far is: 1) using a high-resolution dissecting microscope and an external light source to image the crystal at eight different orientations of light; 2) stacking these images and using ImageJ to process the stack; and 3) obtaining distributions of the grain area and orientation angle from ImageJ to characterize the crystal and using boundary-to-boundary analysis for rQPM applications with a step size equal to the average grain width and a decreased resolution by filtering out widths less than five pixels.

4. EXAMINING THE EFFECT OF GENETIC VARIATION IN *DROSOPHILA MELANOGASTER* ON THE COST OF REPRODUCTION. *Sophie Dudeck*, Alabama School of Fine Arts (Teacher-sponsor: Rebecca Thrash).

The cost of reproduction theory says that reproduction can negatively impact an organism's life span since it requires resources to be reallocated for the reproductive processes. Studies on this theory, particularly in the fruit fly, *Drosophila melanogaster*, largely ignore the use of genetic diversity and both sexes. This lack of information creates a gap in our understanding of the theory since many effects are sex-specific. Diverse strains of *D. melanogaster* are necessary since longevity is influenced by genetic background and varies by strain. Of the 15 genotypes used in this study, 10 were found to have significant interaction effects between sex and mating status on the risk of mortality, which have not been examined in other studies. The effects on reproduction alone were not significant across all genotypes, which could point to the theory being genetically dependent, showing a need for further experimentation. The cost of reproduction requires the diverse backgrounds of *D. melanogaster* so that we can gain a better understanding of the theory for other organisms and the evolution of life-history trade-offs.

5. LOSS OF HIPPOCAMPAL DAY-TIME INHIBITION IN ALZHEIMER'S DISEASE AND ITS CONTRIBUTION TO COGNITIVE IMPAIRMENT AND AMYLOID- β PATHOGENESIS. *Rachael George*, Alabama School of Fine Arts (Teacher-sponsor: Rebecca Thrash).

6. AN INVESTIGATION IN FRACTIONAL CALCULUS AND ITS APPLICATIONS. *Jacob Glidewell*, Alabama School of Fine Arts (Teacher-sponsor: Rebecca Thrash).

In recent years, fractional calculus has gained a lot of attention with the discovery of its many applications. Since the days of Leibniz, many mathematicians have asked if derivatives and integrals can be extended to fractional order similar to exponents. A development of fractional calculus is shown. Additionally, a few properties and abstractions are presented that seem useful in the study of fractional derivatives. Finally, we discuss two recent applications and the interpretation of the use of fractional calculus in economic indicators and particular diffusion.

7. DEVELOPING A DECISION-MAKING MODEL TO ANALYZE AIR POLLUTION REMEDIATION WITH TREES: BIOREMEDIATION OF PM_{2.5}, NO₂, AND CO IN BIRMINGHAM, ALABAMA. *Abhinav Gullapalli*, Hoover High School (Teacher-sponsor: Janet Ort).

Birmingham, Alabama, has a long history of industrial pollution. The impacts of past and current transportation and industrial particle pollution on humans are exacerbated by environmental injustice and cause concern for public health. Chronic exposure to particle pollution has been shown to impact brain, respiratory, and immunological health. Trees have been shown to reduce particle pollution. This study utilized a Particle Photon IoT sensor to record and compare the concentrations of PM_{2.5}, NO₂, and CO in Birmingham's various urban and suburban sites. The study also used iTree's MyTree v1.5 calculator to analyze the abilities of 232 trees, common to the southern United States, to reduce levels of PM_{2.5}, NO₂, and CO. A Java program was created to aggregate the tree data from MyTree by annual reduction, in ounces, for PM_{2.5}, NO₂, and CO. The program employs a system of weighted priorities based on corresponding Air Quality Index values determined through the EPA's AQI Calculator for recorded pollutant levels to deliver a comprehensive list of trees ranked by their overall effectiveness in reducing the studied pollutants. A Python program using the PuLP library was developed to recommend the number of each of the top eight trees to plant in order to optimize air quality while adhering to a simulated budget and space constraints. The computer programs developed in this study can be applied to any city in the world to deliver a site-specific solution for ideal, native trees to efficiently reduce targeted pollutants and promote environmental justice for all.

8. THE EFFECT OF NITROGEN ON *TRIGOLIUM REPENS*. *Elizabeth Hill* and Jenifer Jaynes, Fairhope High School (Teacher-sponsor: Mary Stuart).

The experiment conducted tests to determine if giving a white clover plant more nitrogen would affect its growth rate and the number of root nodules present. Nitrogen is an essential element for life on Earth. For plants to be able to access this element, it must be converted into a usable form through nitrogen fixation. *Trifolium Repens*, or the white clover, has a symbiotic relationship with rhizobia, a nitrogen-fixing bacteria in the soil. Rhizobia forms root nodules in the plant, which give the white clover nitrogen and the bacteria a place to live. When the white clover has more nitrogen available through the minerals in the soil, it should theoretically develop fewer nodules and have an increased growth rate. The results are somewhat inconclusive, as the clover did not grow as well as planned.

9. CLEAR-CUT CLEAR-CUTTING. *Sydney Reeves*, Wetumpka High School (Teacher-sponsor: Virginia Vilardi).

Studies have shown that clear-cutting has negative effects, e.g., stormwater runoff and erosion contaminating underground water streams. But, what effect does clear-cutting have on lakes? Many streams, rivers, and groundwater sources feed into lakes, which can cause a buildup of sediment. How does this affect aquatic life? If clear-cutting has occurred by a stream leading to a lake, then the water quality will be greatly diminished in the surrounding area and where the stream feeds into the lake. The dissolved oxygen level is acceptable between 7–8 mg/L and is optimal at a reading of 9 mg/L or above; the optimal pH levels are between seven and eight. The temperature and turbidity readings for all sites are in the optimal ranges for aquatic life. The pH levels for all sites also stay in the optimal range while the dissolved oxygen readings stay in the acceptable range. In times of non-precipitation and wind, the water quality is not affected by the clear-cutting that has occurred upstream from the test sites. There is still visual evidence of clear-cutting, however, and sediment has been pushed down streams, filling in areas of the lake that were once deeper.

10. THE ROLE OF CONVERSATION AND HEALTH LITERACY IN THE PATIENT-SURGEON ENCOUNTER. *Isabel Silwal*, Alabama School of Fine Arts (Teacher-sponsor: Rebecca Thrash).

Patients with low health literacy experience difficulty understanding health information, which may lead to poor surgical outcomes. In surgery clinics, health information is often presented through conversation. It is unclear, however, if variations exist in patient-surgeon conversations. We hypothesized that variations exist in conversational characteristics between surgeons but that opportunities exist to make improvements. New surgical patients in the UAB Colorectal Clinic were recruited for and consented to the experiment. Health literacy was measured using the Brief Health Literacy Screening Tool (BRIEF). Patient-surgeon encounters were audio-recorded. The patients' understanding was evaluated using a three-item survey. The patients rated their understanding on a scale of one to five, five for complete understanding and one for no understanding. Recordings were transcribed and analyzed for the surgeon's rate of speech, length of visit (LOV), and understandability of words according to the Flesch-Kincaid Ease Score (FKES) and Simple Measure of Gobbledygook (SMOG). Fifty patients were enrolled. The mean age was 49 years (+/- 17.2) and 56% were female. Health literacy levels were adequate (70%), marginal (26%), and low (4%). Significant variations existed in the rate of speech and understandability of words between surgeons ($p < 0.05$). Additional variations existed in LOV by health literacy. Low health literacy patients had the shortest LOV and reported the lowest understandability. Faster rates of speech were associated with less understandability by the FKES and SMOG ($p < 0.05$), shorter LOV, and poor patient understanding. Significant variations exist in the speech rates and understandability of words used at patient-surgeon encounters. Faster rates of speech are significantly associated with less understandable words, and patients with limited health literacy are at-risk for shorter LOV and decreased understanding. Actions can be taken to mitigate the effects of health literacy in the interaction.

11. GENIUSES: BORN OR MADE? *Anna Lei Singleton*, Wetumpka High School (Teacher-sponsor: Virginia Vilardi).

Last year, I researched the qualities of a "genius" by comparing how genetic factors and environmental factors influence overall cognitive development. My hypothesis supported that implementing scholastic activities at an early age would enhance a person's cognition and academic success. Continuing this research, I tested whether the conclusions I made off this

phenomenon could be applied to the multiple intelligences theory. The purpose behind this project is to prove that people are not limited in their opportunities because they do not fit typical intelligence expectations. This experiment shows the importance of different outlets for learning and how vital it is to engage with children at a young age. I predict that if a person puts extensive hours into a particular talent, or intelligence category, then they will perform exceptionally well in it. Moreover, if a child is instilled with education at a young age, they can almost guarantee academic success. Procedures for this experiment were divided into three sections. Part one consisted of making a survey with questions concerning parental academics, early childhood education, current grades, test scores, and study habits and testing people in Math, English, and Reading Comprehension using previous ACT testing material. Part two involved making a survey that questioned the relationship between an individual's behavior and their parents'. And part three included conducting a simple robotic game simulation in which participants were monitored on how their scores improved over an extended period. The data recorded correlations between natural inclinations and extensive practice in intelligence types, influences in early development, personal choice, levels of motivation, and inheritance. My hypothesis was proved under conditional circumstances. The results lead me to wonder whether certain intelligences are more easily inherited than others. Nonetheless, the concepts that I tested could only be accurate if I had full access to people's lives.

12. PHARMACOKINETIC MODELING OF INVITRO DIFFUSION RATES FOR THE ANTIVIRAL ACYCLOVIR. *Nikitha Sridhar*, Auburn High School; Sridhar Krishnamurti, Auburn University; and Babu Ramapuram, Auburn University (Teacher-sponsor: Mark Jones).

Acyclovir is an antiviral drug used in the treatment of *Herpes labialis*, a difficult-to-treat viral infection affecting over 140 million people worldwide. Traditionally, the administration of acyclovir has been by oral or intravenous route. These formulations are effective but face difficulty in clearance from the kidneys in humans with poor renal or immunological function. Topical transdermal (via skin) delivery of acyclovir by cream or gel formulations can provide direct delivery to the site of infection, thereby alleviating nerve pain, reducing viral multiplication, and facilitating clearance. Topical application of acyclovir, an antiviral drug designed to treat herpes infections, was evaluated by using gel formulations with plasma concentrations similar to generic Zovirax formulations. In vitro diffusion rates for a 5% acyclovir solution were collected via vertically-mounted Franz diffusion cells with a dialysis membrane mounted between the donor and receptor compartments. To create an in vivo predictive model of clearance, the in vitro diffusion data above were modified by applying human clearance data for acyclovir from published NIH studies. The obtained data were used to simulate the drug clearance rates in patients with normal renal function and impaired renal function. The in vitro diffusion rates and in vivo clearance rates calculated above were used to model output concentration and clearance variables. Neural networks modeling of data provided statistical algorithms to pair input variables (initial concentrations, release rates, and plasma concentrations) with predicted output variables (output concentration and clearance rate). The results showed a dose-dependent relationship of acyclovir that can be complicated by diffusion and renal clearance mechanisms.

13. CAN BATTERIES BEAT OUT THE KING OF ENERGY STORAGE: HYDRO PUMPING? *Jon Tessier*, Wetumpka High School (Teacher-sponsor: Virginia Vilardi).

This experiment was done to determine if there is a better way to store energy than the most common way, which is hydro pumping. I believed that storing energy in a battery would release a higher percentage of the input energy than hydro pumping, and therefore, storing energy would be more effective in a battery and a better way to store energy. To test this theory, I recorded the power and time required to pump five gallons of water up a distance, and the power and time produced by releasing the five gallons back through a waterwheel. I also tested a battery by lowering the voltage to zero and then recorded both the time and voltage required to charge the battery as well as the time and voltage produced by the battery to return the voltage to zero. Since I was running energy both forwards and backwards through the same circuit, I assumed that the resistance was the same both ways and compared joule ohms instead of joules. The battery ended up being 55% effective and hydro pumping was only 3% effective, which supported my hypothesis by demonstrating that less energy was lost when being stored in a battery.