130th Meeting

of the

Tennessee Academy of Science

November 21, 2020

This virtual meeting is hosted by
East Tennessee State University

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Tennessee Junior Science and Humanities Symposium
Tennessee Psychological Association
Tennessee Science Teachers Association

We hope to see you at our Annual Meeting in 2021 hosted by Tennessee Technological University!

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Welcome . . .

... to the 2020 Annual Meeting of the Tennessee Academy of Science! We hope you enjoy and benefit from this opportunity to present your research, to learn of other research going on in Tennessee, to interact in a relaxed atmosphere with other science professionals, and to participate in the business of the Academy. We are always striving to improve our Academy and its impact upon scientists in Tennessee and beyond.

Announcements

Want to become a member of the Tennessee Academy of Science? Need to pay your annual dues? Visit the Tennessee Academy of Science website.
www.tennacadofsci.org

Dues:
Student $10 annually
Emeritus $10 annually
Member $40 annually
Sustaining $50 annually
Supporting $100 annually
Life $400 single payment In advance of the Annual Meeting

Thank you . . .

... to East Tennessee State University for hosting our meeting!

… to Dr. Gary Henson for serving as the Chair of the Local Arrangements Committee! We appreciate all that you have done to host this meeting.

Meeting Schedule

Zoom links can be found on the Annual Meeting webpage
(http://www.tennacadofsci.org/annual_meeting/general_info.php)

All times listed are CENTRAL STANDARD TIME

Wednesday, November 18, 2020

4:00 pm until 6:00 p.m.	**Session Chair Meeting**

Friday, November 20, 2020

4:00 pm until 6:00 p.m.	**Executive Committee Meeting**

Saturday, November 21, 2020

7:30 a.m. until 1:30 p.m.	**Registration**
8:15 a.m. until 8:30 a.m.	**Poster Session Sign In**
8:00 a.m. until 8:30 a.m.	**Section Chairs Sign-In and Start Poster Zoom Sessions**
8:30 a.m. until 9:45 a.m.	**Poster Presentation and Judging**
10:00 a.m. until 10:30 a.m.	**TAS Annual Business Meeting**
10:30 a.m. until 11:30 a.m.	Welcome by ETSU Interim Dean of Arts and Science, Dr. Joe Bidwell, followed by the Plenary program presented by Dr. Lev Yampolsky, Professor, Department of Biological Sciences, ETSU, Title: "Detecting Selection: What Can Amino Acid Changes Tell Us about Evolution?"
11:30 a.m. until 12:00 p.m.	**Lunch Break**
12:00 p.m. until 2:05 p.m.	**Section Business Meetings/Oral Sessions**
2:05 p.m. until 3:00 p.m.	**Judges Meeting**
3:00 p.m. until 4:00 p.m.	**Student Awards Ceremony**

Meet our Plenary Speaker

Dr. Lev Yampolsky
Department of Biological Sciences
East Tennessee State University

Detecting selection: What can amino acid changes tell us about evolution?

Dr. Yampolsky earned a BS in Biology from Moscow State University and a PhD in Genetics from the Russian Academy of Sciences. He held postdoctoral appointments at Northern Illinois University, Cornell University, University of Georgia, and University of Maryland/NIST. He has been a faculty member at Eastern Tennessee State University since 2001. His major research interest is in the area of the evolution of gene expression in response to changes in the environment (temperature, nutrients, xenobiotics) or genetic background (chromosomal aberrations, gene duplications). Differential gene expression is the molecular basis of phenotypic plasticity. Dr. Yampolsky investigates the role of adaptation and environmental constraints in the shaping of differential gene expression. Does plastic gene expression impede adaptive evolution or provide a new target for selection? If plasticity of gene expression is lost in a constant environment, does it occur by neutral processes or by selection operating through across-environmental trade-offs? He attempts to answer these and other questions using microarray and RNAseq technology as well as bioinformatics. His study organisms include Drosophila, Daphnia, and Lake Baikal (Siberia) endemic crustaceans.

Notations used in abstracts: (*) student author and (#) presenting author, if not first author

Oral Presentations

Agriculture-1
Economics/Marketing
Chair: Dr. Anthony Witcher

12:00 pm – 2:05 pm

12:00-12:05 Business Meeting – to be held jointly with Agriculture 2 & 3

12:05-12:20 Statistical model for making informed decisions on the purchase of used farm equipment. ***Jackson Baxter*, Anthony R. Delmond, Sandy Mehlhorn, John Cole, and Joey Mehlhorn***, *University of Tennessee at Martin, Martin, Tennessee*. Farm machinery is a substantial component of a farm's fixed costs. With farm equipment prices increasing every day, farmers need a benchmark to follow when deciding to buy new equipment over used equipment. Likewise, private sellers need an outlet to know what their used equipment is worth, when trading or selling. Currently, there is no widely used method for private sellers to make this determination independently. Utilizing statistical methods, we have constructed a model that can indicate a baseline for farmers to know what their used equipment is worth. This model will help sellers make more informed decisions on the price to place on their products, and it will help buyers determine the fairness of a seller's price relative to the market. This will allow both buyers and sellers of farm equipment to be more informed and it will remove some of the information asymmetry inherent in the buying process.

12:20-12:35 Woke farming: A socially-conscious and sustainable marketing plan for a new era. ***Desmond Lewis*, and Anthony R. Delmond****, University of Tennessee at Martin, Martin, Tennessee*. Black row crop farming has faced many challenges over the years. From the decrease in Black-owned agricultural acreage to exorbitant equipment costs, Black farmers have struggled to maintain their market standing within the row crop landscape. Conventional row crop farming has struggled to remain consistently profitable with small acreage, further hastening the demise of Black producers. This case study develops a new business model for small row crop operations focused on sustainable financial, marketing, and production methods. The crop portfolio of this operation is centered around popcorn and cotton grown on ten acres or fewer, where the producer is responsible for marketing the crop. In addition to its implications for sustainable farming practices for small row crop operations, this model outlines the potential for social change with respect to the historical declines in Black row crop producers and acreage and addresses the issue of food insecurity in rural areas.

12:35-12:50 The role of technology in marketing local foods in Tennessee***. Blessing Ajumobi*, Enefiok Ekanem, and Mary Mafuyai***, *Tennessee State University*, *Nashville, Tennessee*. The objective of this paper is to examine how access to technology impacts marketing of local food in Tennessee. Secondary data from the U.S Census of agriculture, USDA's National Agricultural Statistics Service, Tennessee Department of Agriculture, and published information was used to provide background to the local food industry in Tennessee. Data collected from online survey of 200 local food sellers were used in analyzing the role of technology in the marketing of local food in Tennessee. Results show that state and local governments play a crucial role in the production and marketing of local food in Tennessee, through the development of food policy. The continued increase in consumers' demand for naturally grown food and limitations of food policy on local food marketing should be of interest for further research. Findings from this research could contribute to the literature on the growth of small agribusinesses in Tennessee.

12:50-1:05 An investigation of undergraduate agriculture student attitudes toward international agriculture. ***Maegan Hollis* and Chaney Mosley***, *Middle Tennessee State University, Murfreesboro, Tennessee*. The purpose of this study was to investigate the attitudes of undergraduate agriculture students toward international agriculture. The objectives were to determine the difference in attitudes of undergraduate agriculture students toward international agriculture between: (1) males and females; (2) students who had or did not have agriculture coursework in high school; (3) different agriculture majors; and (4) different classifications (freshman – senior). Results of a two sample T-test assuming unequal variance indicated there was not a significant difference between (1) males and females and (2) those who had agriculture coursework in high school and those who did not. Results of a single factor ANOVA indicated there was not a significant difference between (3) agriculture majors; and (4) classifications. Gender, agriculture coursework in high school, choice of agriculture major and undergraduate classification do not have an effect on attitudes toward international agriculture.

1:05-1:20 An examination of undergraduate agriculture student attitudes toward sustainable agriculture. ***Chaney Mosley* and Maegan Hollis***, *Middle Tennessee State University, Murfreesboro, Tennessee.* The purpose of this study was to examine the attitudes of undergraduate agriculture students toward sustainable agriculture. The objectives were to determine the difference in attitudes of undergraduate agriculture students toward sustainable agriculture between: (1) males and females; (2) students who had or did not have agriculture coursework in high school; (3) different agriculture majors; and (4) different classifications (freshman – senior). Results of a two sample T-test assuming unequal variance indicated there was not a significant difference between (1) males and females and (2) those who had agriculture coursework in high school and those who did not. Results of a single factor ANOVA indicated there was not a significant difference between (3) agriculture majors; and (4) classifications. Gender, agriculture coursework in high school, choice of agriculture major and undergraduate classification do not have an effect on attitudes toward sustainable agriculture.

1:20-1:35 A method of evaluating economic contribution of local food system: A case study of Tennessee. ***Oluwatooni Ajayi*, Ekanem Enefiok, and Mary Mafuyai***, *Tennessee State University, Nashville, Tennessee*. The trends in local foods have incited the interest of research authors, with a varying approach to local food enterprises in the different parts of the country. Most of the studies on the economic impact of local foods limit their discussion to a specific component of the local food system such as the farmers market. Another aspect of research has focused on the use of a certain type of methodology to assess the economic impacts. This has led to an ununified approach in the definition and evaluation of the local food system resulting in an ambiguous economic modeling. This study provides a hypothetical extraction method to measure the economic contribution of local foods across all potential sectors in Tennessee (this includes producers and processors). Through providing a comprehensive methodological approach, this body of work models a method that can be applied to several definitions and interpretations of the local food system.

1:35-1:50 Influence of demographics, physical activity, and status on willingness to pay for organic foods and implications for farmers markets. ***Julia E. Knaggs*, J. Ross Pruitt, Marco A. Palma, and Lindsay Anderson***, *University of Tennessee at Martin, Martin, Tennessee (JEK, JRP, LA), and Texas A&M University, College Station, Texas (MAP)*. Consumers are known to signal status through their purchasing behaviors. As the food industry continually expands its use of strategic marketing to reach customers, understanding food's connection to this kind of status signaling may open new markets for producers. This study explores the influence of demographics, physical activity level, and status on an individual's willingness to pay for a basket of organic foods. Over three days, participants had their activity level measured by a pedometer, were randomly assigned status level, and placed bids in a second price auction. Analysis showed that women were willing to pay more on average than men, while Hispanic and

Asian shoppers were willing to pay more than their white counterparts. However, physical activity and randomly assigned status had no significant impact on willingness to pay. Overall, this study indicates certain demographics, but not physical activity or status itself, may influence status signaling through food purchases.

1:50-2:05 Business risk perception and financial decisions among small agricultural operations in Tennessee. ***Sudip Adhikari* and Aditya Khanal***, *Tennessee State University, Nashville, Tennessee*. Several studies have worked on financing and risk balancing behavior (change in financial risk-taking subjected to a different level of business risk). However, the studies specifically examining the risk balancing on small US farms are scant. This study assesses the factors influencing the debt financing decisions of small farms using primary survey data from Tennessee. Specifically, we examined the role of business risk perception on such decisions. We use a general linear model specifying a negative binomial family. Using the extent of debt financing (in percentage) and business risk perception on an ordinal scale, we found that Tennessee's small farmers are likely to have higher debt financing with an increase in perceived business risk—a higher financial risk with an increase in perceived business risk. In addition to perceived business risk, we find that factors like age, education, household size, and agritourism also influence the debt financing decisions.

Agriculture-2
Crops
Chair: Dr. Clint Ary

12:00 pm – 2:05 pm

12:00-12:05 Business Meeting – to be held jointly with Agriculture 1 & 3

12:05-12:20 *Fusarium oxysporum* versus *F. commune*: A misidentification issue. ***Farhat A. Avin, Ravi Bika*, Bhawana Ghimire* and Fulya Baysal-Gurel***, *Tennessee State University, McMinnville, Tennessee*. *Fusarium* species are plant pathogens causing several diseases and leading to major crop and economic losses. *Fusarium oxysporum* and *F. commune* are two putative sister species that might be misidentified. In this study, several molecular marker sequences and morphological features of these two species were used to compare and distinguish between them. Based on the DNA sequences from the translation elongation factor 1α (EF-1α), Internal Transcribed Spacer (ITS), and the Beta-Tubulin (BTU) regions, the isolates and GenBank resources of the two species were analyzed. The constructed phylogenetic tree could strongly demonstrate that the *F. commune* clade is closely related to but independent of the *F. oxysporum*. During the search in GenBank, however, it is found that the *F. oxysporum* has mistakenly identified as *F. commune* and vice versa. While more research is recommended, the results of this study can be used to avoid any misidentification in future research projects.

12:20-12:35 Comparative performance of sanitizers in reducing the plant to plant transfer of *Calonectria pseudonaviculata* in boxwood using cutting tool. ***Ravi Bika*, Teri Simmons, Christina Jennings, and Fulya Baysal-Gurel***, *Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, Tennessee*. The conidia of *Calonectria pseudonaviculata* can be transferred from infected plant to a healthy plant via cutting tools during cultural operation, if tools are not properly sanitized. The objective of this study was to identify effective sanitizers for managing plant to plant transfer of *C. pseudonaviculata* when using cutting tools. The in vitro study was conducted to determine the most effective treatments to

be used in plant study. The plant to plant transfer study was performed using Felco 19 shears as the cutting tool. All the treatments significantly reduced plant to plant transfer of *C. pseudonaviculata* compared to non-treated inoculated; however, alcohol, Green-Shield, Simple green d pro 3 plus, Simple green d pro, KleenGrow and Clorox were the most effective treatments. The findings of this study will help growers for successful management of mechanically transmissible boxwood blight pathogen during production.

12:35-12:50 Management of *Phytophthora cinnamomi* of flowering dogwood (*Cornus florida*) using fungicides, biofungicides, host plant defense inducers and fertilizer in simulated flooding events. ***Krishna Neupane* and Fulya Baysal-Gurel***, *Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, Tennessee*. *Phytophthora* root rot (*Phytophthora cinnamomi*) is one of the major diseases of flowering dogwood (*Cornus florida*). The efficacy of different fungicides, biofungicides, host plant defense inducers and fertilizer were studied to manage *Phytophthora* root rot in different flooding durations. Flowering dogwood seedlings were exposed to a simulated flooding of 1, 3 and 7 days. Treatments were applied 1 week or 3 weeks before flooding. All treatments were applied as drenched to dogwood seedlings inoculated with *P. cinnamomi* 3 days before flooding. At the end of the trial, plant growth data, and root systems were assessed for disease severity using a scale of 0-100%, subsamples were plated on PARPH-V8 medium to determine the percent recovery of *Phytophthora*. Subdue MAXX, Signature Xtra Stressgard and Empress Intrinsic were found to be effective against root rot in both of preventative applications in all 1, 3- and 7-days flooding.

12:50-1:05 Evaluation of chemical and biocontrol products for the management of *Fusarium* root and crown rot of oakleaf hydrangea. ***Sandhya Neupane * and Fulya Baysal-Gurel***, *Tennessee State University, Nashville, Tennessee*. Fusarium root and crown rot caused by *Fusarium oxysporum* of hydrangea is not a common disease but has been issue on some cultivars grown in Tennessee. An experiment was carried out to test the efficacy of different fungicides and biocontrol products for the management of Fusarium root and crown rot. Oakleaf hydrangea 'Queen of Hearts' plants were inoculated by drenching 150 ml of 1×106 conidia/ml suspension and the treatments were applied by the rate and interval provided by manufacturing company. The disease severity was assessed using a scale of 0-100% roots/crown affected. Treatments that most effectively reduced *Fusarium* root rot disease severity were BAS75002F, the low rate of MBI121, the low rate of Postiva, the low rate of SP2700, TXC2020 (applied 6 DAI), the low rate of Astun, Terraguard + the low rate of Astun, and KleenGrow. The treatment that effectively reduced crown rot disease severity was Empress.

1:05-1:20 Weed control in propagation using mulches. ***Isha Poudel* and Anthony Witcher***, *Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, Tennessee*. Limited methods are available for controlling weeds in cutting propagation, but mulches may be a viable option. We evaluated the effects of mulch type (vermiculite, rice hulls, paper pellets, and pine pellets) and depth (0.5 and 1 inch) on rooting of crape myrtle cuttings and weed control of oxalis and mulberry weed. Paper pellets suppressed crape myrtle root length and volume and shoot and root dry weight at both mulch depths. Root dry weight was not affected by pine pellet or rice hull at either depth. Mulberry weed and oxalis growth was suppressed by pine pellets and paper pellets at both depths, while oxalis was also suppressed by rice hulls (both depths). Vermiculite did not affect crape myrtle rooting, but provided poor weed control. We concluded that pine pellets applied at 0.5-inch depth provided effective weed control with minimal effects on rooting of crape myrtle.

1:20-1:35 Assessing the effect of winter canola varieties on canopy cover and germination rate. ***Manasarobar Bhattarai* and Jason P. de Koff***, *Tennessee State University, Nashville, Tennessee*. Canola (*Brassica napus* L.) has been identified as the source of healthy edible oil, animal feed byproduct and a good cover crop. Advances in breeding activities for winter canola have been able to introduce new

varieties. As new varieties are continuously released, there is the need to identify how they perform, particularly in southeastern U.S. where less research has been done. In 2020, a study was conducted at the Tennessee State University Agricultural Research and Education Center in Ashland City, TN with 24 varieties in a randomized complete block design with four replicates of each variety. As winter canola is an important cover crop, the results that will be discussed will add new knowledge about the varieties that provide the most cover in the shortest period of time in Tennessee.

1:35-1:50 Application of geospatial technology to identify topographic undulations and maximizing the production of a bare-root seedling nursery. ***Sarah Plumb and Solomon Haile****, *Tennessee State University, Nashville, Tennessee*. Identification and precise measurements of topographic undulations in forest nursery beds are critical to avoid water accumulation and associated difficulty to operate nursery equipment. Geospatial technology was used to predict maximum stock production capacity by identifying and precisely measuring topographic undulations at the East Tennessee Nursery. Remote sensing data was combined with GPS data to measure elevation change and seedbed area within the nursery's four largest seedling compartments. Elevation profile graphs, reclassified digital elevation models, and a weighted-value decision matrix was used to inform nursery management in which compartments should plan on raising seedlings in the next planting cycle to avoid flood damage. The results of the study indicate that the seedbed area, seedlings sold, and revenue could increase by 30.7% if the nursery operated at maximum capacity. The study alluded that a high resolution of digital elevation sources is useful for monitoring and to make informed operational management decisions.

1:50-2:05 Characterization of volatile compounds in canola flowers for pollinator attraction. ***Taqdeer Gill*, K.D. McGeary and Jason de Koff***, *Tennessee State University, Nashville, Tennessee*. Winter canola is an oilseed crop that can produce edible oil, animal feed byproducts and biofuel. Pollinators are essential for reproduction of plants and enhancing yields. Volatile compounds released by the plants attract pollinators. However, worldwide the population of pollinators is decreasing. The objective of this study was to identify volatile compounds emitted by winter canola flowers that have potential for pollinator attraction and if they are affected by variety or N application rate. Three varieties of winter canola were planted in 2018 under different N rates. Flowers collected in April 2019 were analyzed using a HERCALES GC Flash electronic nose to detect volatile compounds. Preliminary findings indicate that many compounds that are known be pollinator attractants, such as vanillin and methyl cinnamate, were detected in the winter canola flowers. Identification of volatile compounds with pollinator attraction potential may help determine winter canola's role in mitigating losses in pollinator populations.

Agriculture-3
Food/Animal
Chair: Dr. Anthony Delmond

12:00 pm – 1:05 pm

12:00-12:05 Business Meeting – to be held jointly with Agriculture 1 & 2

12:05-12:20 A novel algorithm for the prediction of UV fluence in a pilot-scale dean flow UV system: Development and validation. ***Pranav Vashisht*, Ankit Patras, and Brahmaiah Pendyala***, *Tennessee State University, Nashville, Tennessee*. UV systems have been extensively investigated for high-transmittance fluids (i.e. beverages) but their efficiency is rather poor for treating opaque fluids. This study evaluates the ability of UV-C light to inactivate foodborne pathogens in simulated opaque fluid and

develops novel algorithm for prediction of reduction equivalent fluence (REF) or UV dose in a Dean Flow UV system. An algorithm was developed for prediction of REF in fluids with challenging optical properties (absorption coefficient: 6.5-17 per cm) at commercial relevant flow conditions (31.70, 63.40, 95.10 gallons/hour). REF scaled-up linearly as an inverse function of absorbance and flow rate ($R2 > 0.96$, $p<0.05$) indicating efficient mixing in the reactor. The algorithm was tested and validated against independent experiments using *E. coli* and *Salmonella Typhimurium*. The predicted and experimental results were in close agreement. This study also demonstrated that the system effectively inactivated *E. coli, Salmonella Typhimurium* and MS2 bacteriophage in fluids (99.99%).

12:20-12:35 An exploration of undergraduate agriculture student attitudes toward animal welfare. ***Chaney Mosley and Maegan Hollis***, *Middle Tennessee State University, Murfreesboro, Tennessee*. The purpose of this study was to explore attitudes of undergraduate agriculture students toward animal welfare. The objectives were to determine the difference in attitude of undergraduate agriculture students toward animal welfare between: (1) males and females; (2) students who had or did not have agriculture coursework in high school; (3) different agriculture majors; and (4) different classifications (freshman – senior). Results of a two sample T-test assuming unequal variance indicated there was a significant difference between (1) males and females and (2) those who had agriculture coursework in high school and those who did not. Results of a single factor ANOVA indicated there was not a significant difference between (3) agriculture majors; and (4) classifications. Females and students that had agriculture coursework in high school have greater concern for the welfare of animals. Agriculture major and undergraduate classification do not have an effect on concern for the welfare of animals.

12:35-12:50 Sorghum microspore exine development stages towards individual gamete isolation for genotyping. ***Dilovan K. Yahya*, Aron Felts, and Ahmad Aziz***, *Tennessee State University, Nashville, Tennessee*. Sweet sorghum is gaining importance as a raw material for ethanol production and is the 5th cereal grain crop worldwide. Mature male gametes have a sporophyte-derived exine layer that prevents cellular DNA extraction. To access gametic DNA in plants, it is crucial to identify their cell wall development stages. Therefore, during microsporogenesis, it's best to isolate single cells immediately after the tetrad stage. Sessile spikelets measuring 3.3 – 3.7mm were dissected from panicles under a microscope to retrieve anthers. Individual cell isolation was achieved by using CellTram micro-injector mounted on an ultrafine move Marzhauser micromanipulator. Free early microspores were lysed, and their genomic DNA's were amplified using REPLI-g Single Cell Kit. Whole genome amplifications were confirmed by NanoDropTM One DNA quantification through UV-Vis Spectrophotometry. Simple sequence repeats (SSR's) were analyzed for segregation of parental DNA markers. In this report gamete merit based genetic assessments are facilitated while reducing the cost lost.

12:50-1:05 Disruption in the US food supply chain: The case of COVID19 pandemic. ***Mary Mafuyai* and Enefiok Ekanem***, *Tennessee State University, Nashville, Tennessee*. The COVID19 pandemic has caused serious disruptions in the entire US food supply chain. Travel restrictions and limitations affected the delivery of farm, ranch and food products. Producers were stuck with produce on their farms and ranches that could not be delivered to processors or the market place. The national lock-down and severe travel restrictions affected farm workers, harvesters, and truckers from working in the entire food supply chain. Food distribution, an important part of that chain, witnessed notable changes with sudden and unexpected shocks to demand and supply of food causing serious changes in prices. This paper analyses the impact of factors associated with food supply chain. An online survey was used in collecting the data needed for this paper. Qualitative methods were used in analyzing data collected. Findings from this study should be of interest to researchers, extension educators, marketers, consumers, policy makers, and stakeholders interested in agriculture.

Botany and Cell & Molecular Biology
Chair: Cooper Breeden

12:00 pm – 1:05 pm

12:00-12:05 Business Meeting – two section meetings to be held

12:05-12:20 Two disparate worlds collide: An overview of the growing mutual relationship between Botany and machine learning. ***Dakila Ledesma* and Joey Shaw***, *University of Tennessee at Chattanooga, Chattanooga, Tennessee*. The digitization of natural history records, such as those accrued from citizen sciences or herbarium sheet specimens, is generating a large dataset with many unexplored novel applications. Concerted efforts of researchers and volunteers has made millions of Plantae records, with associated images available on open portals such as iNaturalist and SERNEC. In many other fields outside of Botany, the use of machine learning (specifically neural networks) has seen a recent surge of popularity, interest, and innovation. However, many of these innovations do not translate well to their usage in botanical tasks, with botanical data tackling many of the large deficiencies within current machine learning methodologies. We discuss the small but growing interest of machine learning engineers to use botanical data to solve these deficiencies, and how Botany may be helped significantly by the automation of many manual, short-staffed, or unexplored processes.

12:20-12:35 The vascular flora of Booker T. Washington State Park, Hamilton County, Tennessee. ***Jada S. Williams* and Joey Shaw***, *University of Tennessee at Chattanooga, Chattanooga, Tennessee*. Booker T. Washington State Park (BTW) is a 363-acre park along the shore of Chickamauga Lake in Hamilton county, Tennessee. It is in the Ridge and Valley ecoregion, a relatively lower elevation region between the Cumberland Plateau and Blue Ridge Mountains. The Ridge and Valley is a heterozygous region characterized by low rolling hills, limestone and dolomite valleys, Appalachian oak forests, and bottomland oak forest. The goals of this project are as follows: inventory the vascular flora of BTW, report rare, non-native, and invasive species, and design a self-guided activity for visitors that showcases common species and communities. Plants are collected, pressed, and identified using the Flora of Tennessee. The collection started in February 2020 and currently holds 240 specimens across 214 species, 162 genera, and 76 families. Prevalent invasive species include *Ligustrum sinense*, *Lonicera japonica*, and *Albizia julibrissin*. Rarest plants found include *Dryopteris celsa*, *Maianthemum racemosum*, and *Tipularia discolor*.

12:35-12:50 Using herbarium specimens to trace heavy metal pollutants and compare them pre- and post- 1969 in the formerly most polluted city in the United States, Chattanooga, Tennessee. ***Megon Stepaniuk and Joey Shaw***, *University of Tennessee at Chattanooga*. Here we use herbarium specimens collected throughout the last 100 years from the greater Chattanooga area to screen them for the presence and concentration of heavy metals. In 1969, Chattanooga was declared the most polluted city in America due to unchecked industrial emissions. Heavy metals can be deposited atop plant surfaces, taken in through gas exchange, or even taken up through the soil when heavy metals find a sink there. We searched SERNEC to determine which species were the most common throughout Chattanooga, had multiple specimens available during the times indicated, and had enough biological material on the specimen to take samples without damaging it. There are 499 total specimens collected that meet the criteria. We intend to collect data on heavy metal concentrations in the vegetation surrounding Chattanooga from before Chattanooga was polluted, during the time in which it was considered the most polluted city in the country, and for the present to (1) indicate peak years of heavy metal concentration in regional vegetation and (2) if the vegetation surrounding Chattanooga has returned to pre-pollution levels.

12:50-1:05 Androgenic responses of sweet sorghum microspore in culture. ***Aron Felts* and Ahmad Aziz***, *Tennessee State University, Nashville, Tennessee*. Androgenesis can be achieved in sweet sorghum through harvesting mass numbers of immature microspores, environmental stressors, and plant growth regulators. Mature microspore (pollen) populations represent the entire genomic population and allows environmental factors to be applied to pre-ignite microspores to transfer from a maturation pathway towards embryogenesis. Two varieties of Sorghum bicolor L. (Dale and Topper 76-6) were grown in a greenhouse to harvest panicles containing immature microspores. By targeting the flag leaf deployment date, a timeline to harvest immature panicles containing large numbers of immature pollen cells was created. After submitting panicles to a 21-day cold treatment at 4 °C, microspores were plated on MS media containing 30 grams of sucrose with various concentrations of plant growth regulators. 2,4-D and Kinetin showed significant influence on creation of friable and compact calli. These calli have the potential to create double haploid homozygous plants.

Chemistry
Chair: Dr. Wilson Gichuhi

12:00 pm – 1:20 pm

12:00-12:05 Business Meeting

12:05-12:20 *Bis*-1,2,4-triazinylpyridines as a new ligand class for metal-mediated amination of arenes. ***Mariah L. Tedder* and Jesse D. Carrick***, *Tennessee Technological University, Cookeville, Tennessee*. The formation of new carbon-nitrogen bonds can be accomplished through both classical and modern methods. In contrast to classical methods like SN2, SNAr, or nitration-reduction strategies, modern methods such as copper-catalyzed Ullman couplings frequently leverage metal-mediated catalysis to afford transformations in a more efficient manner. In order to broaden the scope of potential substrates and products, different ligands have been applied to these catalytic methods to potentially result in more specific transformations. Our group has found that benchtop and air stable *bis*-1,2,4-triazinylpyridines (BTPs) can be employed in copper-catalyzed aminations, with sub-stoichiometric copper loadings and low ligand loadings to afford amination products of aryl halides with various functionalized amines. Selected optimization strategies and synthetic results will be reported.

12:20-12:35 Factors that determine the concentration of capsaicin in different pepper types. ***Sugeidy Sanchez-Xalate* and Sarah S. Pierce***, *Cumberland University, Lebanon, Tennessee*. Capsaicin is the main compound in peppers that specifically triggers the transient receptor potential vanilloid 1 (TRPV1) ion channel. TRPV1 of the body signals the brain that a food is spicy. The amount of capsaicin is interesting because humans are the only ones who find spicy flavors appealing, while other animals are repulsed by it. This gives rise to an interest in quantifying the amount of capsaicin in peppers. Capsaicin concentration was determined in three different pepper types including Jalapeño, Serrano, and Cayenne. A solid-liquid extraction was used to isolate the capsaicin, followed by UV-VIS spectroscopy to determine the amount of capsaicin in each pepper. The concentration of capsaicin in Jalapeño and Serrano peppers are not significantly different. However, Cayenne peppers have a lower concentration of capsaicin. Our data indicated that the color of the pepper did not affect capsaicin concentration.

12:35-12:50 Oxidative cyclization of 2-pyridyl *N*-tosylhydrazones toward unsymmetrical 1,2,3-triazole complexants. ***Zachary Z. Gulledge* and Jesse D. Carrick***, *Tennessee Technological University, Cookeville, Tennessee*. In continuation with this lab's work towards the synthesis of novel N-donor

ligands for use in minor actinide separations from spent nuclear fuel, the synthesis of unsymmetrical tridentate ligands containing a 1,2,3-triazole moiety were explored. Installation of the 1,2,3-triazole functionality through iodine-mediated oxidative cyclization of functionalized 2-pyridyl *N*-tosylhydrazones with commercially available aniline derivatives via microwave irradiation presents an alternative to metal assisted azide-alkyne 3+2 cycloaddition by necessarily avoiding the use of metal catalysts and azides without sacrificing potential substrate scope. This ligand class is unknown in the primary literature and could offer improvements in chemoselectivity or solubility in organic diluents compared to symmetric ligands more commonly studied. Current synthetic progress of tridentate ligands containing an N-substituted 1,2,3-triazole and their relevant derivatives will be discussed.

12:50-1:05 Tracking the presence of contaminants in biological samples and their effects on protein expression. ***Baily W. Ford* and Marcia M. Schilling***, *Austin Peay State University, Clarksville, Tennessee*. Pilot experiments using two-dimensional electrophoresis, atomic absorption spectrometry, nuclear magnetic resonance, and electron dispersion spectroscopy were conducted in order to assess traceability of contaminants in whole sentinel organisms during developing environmental studies. Proteins were isolated from *Escherichia coli* cultivated in the presence of lead, arsenic, and glyphosate and from a healthy control group. Samples with high concentration of contaminants were assessed by two-dimensional polyacrylamide gel electrophoresis and compared to gels of healthy specimen. Lead presence was verified with atomic absorption spectroscopy; nuclear magnetic resonance was utilized to confirm glyphosate contamination. Arsenic was introduced to soil samples and analyzed with electron dispersion spectroscopy to test if it could be verified when compared to uncontaminated soil samples. This experiment indicated that the aforementioned methods can be applied to a wide array of biological systems by detecting the presence of contaminants in soil and analyzing its effects on protein expression in its inhabitants.

1:05-1:20 The synthesis of Dilantin using solar irradiation. ***Dan Swartling and Veronica Sublett***, *Tennessee Technological University, Cookeville, Tennessee*. Our research has been focused on doing green and sustainable chemistry in the synthesis of pharmaceuticals. Dilantin can be made in 3 steps starting from benzaldehyde coming from bitter almond oil. The procedures and chemicals used will be discussed.

Ecology & Environmental Science
Chair: Dr. LaRoy Brandt

12:00 pm – 1:35 pm

12:00-12:05 Business Meeting

12:05-12:20 Development of a cover crop system for management of flatheaded borers in red maple production. ***Axel Gonzalez, Sujan Dawadi, Jason B. Oliver and Karla M. Addesso***, *Tennessee State University, Nashville, Tennessee*. Cover crops can provide a wide range of benefits in agriculture production including improvement of soil physical, chemical, and biological properties. Studies show that cover crops can also reduce pest densities by providing a habitat for beneficial insects and altering host microclimates. In woody ornamental production, flatheaded borers (*Chrysobrothris* sp; FB) are serious pest that infesting tree trunks. They are especially damaging during the first two years following transplanting. After tree establishment, attacks decrease, but they may still occur at some level during subsequent production years. Previous research indicated that a winter cover crop grown at the base of susceptible trees during the first two years can minimize FB attacks on red maple (*Acer rubrum* L.)

transplants. The trees in the original experiment were assigned to four treatments (cover crop, cover crop + insecticide, bare row and bare row + insecticide) and replicated four times in a randomized complete block design with 25 trees per block. All treatments were evaluated for FB damage and tree growth impact for the first two years. The efficacy of the winter cover crop was confirmed by controlling FB damage during years 1 and 2, with results similar to systemic imidacloprid treatments, which is the recommended treatment method for controlling FB in nursery production. As a result of the direct competition for nutrients and water tree growth in cover crop study were followed for an additional two years under standard production methods. Tree rows in all treatment were maintained bare with pre- and post-emergent herbicide to avoid weed competition. During years 3 and 4, trees were further evaluated for growth and additional FB attacks were recorded. At the end of year 4, trees in the cover crop treatment showed some growth recovery, however, they remained smaller than trees growth under standard insecticide and herbicide production practices for all four years (24% smaller trunk diameter, 18% shorter). Additional management techniques will be required to mitigate the growth disparities between treed grown with cover crops and standard methods. Potential management options to explore include early-kill of cover crops and in-field irrigation of newly transplanted trees.

12:20-12:35 The survey of soil temperature, humidity, and quality and their impact on earthworm density and aestivation at Reelfoot Lake station in summer as well as the impact of temperature and humidity on earthworm (*Lumbricus terrestris*) survival in earthworm farms. ***Taylor A. Burress*, Chloe Smotherman*, and Donald Shaw***, *University of Tennessee at Martin, Martin, Tennessee*. Studies have reported that a Canadian species of earthworm prefer temperatures of 15-20 degrees Celsius and 25% soil moisture. Earthworm aestivation has been reported in dryer environments. Sites at Reelfoot Lake were selected for studying soil temperature and humidity, earthworm density, and aestivation in summer. The soil collected was analyzed. In the lab, earthworm farms were set up under different temperature and humidity conditions and were monitored weekly. We found earthworm density was significantly higher in the Grassland group compared to the Forest Edge group while humidity was a limiting factor. Aestivation was scarce in all groups. Soil data had showed that nitrate nitrogen was lower in the Waterfront group compared to other groups. We found earthworm survival was significantly higher under 10 degrees Celsius across a 4-week duration. Optimal Grassland humidity contributes to high earthworm density and temperature is a principal factor on earthworm survival in the lab.

12:35-12:50 Investing xylene and toluene in disadvantaged communities downwind of LAX. ***Jacob Schenthal and Donald Blake***, *Vanderbilt University, Nashville, Tennessee (JS) and University of California Irvine, Irvine, California (DB)*. Airports are known emitters of air pollutants, and often have elevated levels of less prevalent compounds, such as xylene and toluene. Both xylene and toluene are toxic, with their major anthropogenic sources being paints, solvents, and fuels. Our study uses low-altitude airborne data from six separate years, spanning 2011 to 2017 from NASA's Student Airborne Research Program (SARP). We utilized HYSPLIT trajectories and isopentane to xylene/toluene ratios to trace the source of the pollutants to the Los Angeles International Airport (LAX). Our results find higher slopes of isopentane/VOC further downwind from LAX, indicating gradually decreasing levels of xylene and toluene farther from LAX. This suggests that LAX may be affecting these communities with large continuous enhancements of VOCs, not limited to just xylene and toluene. Enhanced levels of VOCs in these communities may contribute to higher rates of health issues among residents - a major issue of environmental justice.

12:50-1:05 Use of ecological niche models to inform management strategies for the vulnerable Tennessee dace (*Chrosomus tennesseensis*). ***Maggie E. Coffey*, Thomas F. Laughlin, T. Andrew Joyner, and M. Kevin Hamed***, *East Tennessee State University, Johnson City, Tennessee (MC, TL, AJ), and Virginia Polytechnic Institute and State University, Blacksburg, Virginia (KH)*. The Tennessee dace

(*Chrosomus tennesseensis*) is an endemic freshwater minnow that inhabits headwater streams of the Upper Tennessee River Basin (UTBR). This species is listed as State Endangered in Georgia and Virginia and as a Greatest Conservation Need species in Tennessee. Threats to the Tennessee dace include localized extirpations resulting from anthropogenic disturbances and hydrologic regime fluctuations within its specialized habitat. Conservation efforts for this species are limited by knowledge gaps regarding its current distribution. The aim of this study was to use ecological niche modelling (ENM) to characterize the fundamental niche of the Tennessee dace. Previous occurrence records and relevant bioclimatic and freshwater-specific variables were used to train models. Predictions indicate that the distribution of the Tennessee dace may extend beyond its accepted range in the UTBR. Field surveys targeting high suitability streams can be used to validate these results and inform future management decisions for this species.

1:05-1:20 Investigating temperature effects on the ecology and life history of the exotic *Daphnia lumholtzi*. ***Melissa Pompilius* and Robert Fischer***, *Middle Tennessee State University, Murfreesboro, Tennessee*. *Daphnia lumholtzi* is an exotic zooplankton species that quickly colonized diverse aquatic habitats throughout the US, yet little is known about the traits that enable *D. lumholtzi* to colonize novel environments. We conducted life history studies to characterize the traits that contribute to the high colonization potential of this species. Life history traits were monitored at 23°C versus 30°C in *D. lumholtzi* collected from an Alabama estuary and Pickwick reservoir in Tennessee. Median lifespans were similar at 23°C (range 18-24 days), while generation time (range 16.3-20.6 days) and lifetime reproductive potential (range 27.7-48.5 offspring/female/generation) varied among all three clones. At 30°C, life history traits were also variable, with decreased generation time (range 6.0-10.6 days) and lifetime reproductive potential (range 2.8-11.9), coupled with a lower median lifespan. High variability in life history traits within *D. lumholtzi* populations may be an important factor facilitating their ability to colonize novel environments.

1:20-1:35 Fecal bacterial survey of waterfowl in the Cumberland Gap - Tennessee and Kentucky. ***Carson Schumann*, Karen Gruszynski, and Whitney M. Kistler*****,** *Lincoln Memorial University, Harrogate, Tennessee*. Waterfowl can carry several zoonotic pathogens and are often found in areas where they interact with people. Between February and March 2020, fecal samples from Canada Geese *Branta canadensis* and Mallards *Anas platyrhynchos* were sampled in the Cumberland Gap Area. Samples were acquired by finding flocks of geese or ducks, waiting for them to defecate, and then swabbing the fecal contents. Twenty samples from four different locations were collected and sent to the University of Kentucky for anaerobic cultures and bacterial identification using MALDI-TOF. A total of 39 colonies were tested with MALDI-TOF from the 20 samples. Of the 39 bacterial colonies there where 20 distinct species of bacteria identified. A common bacterium found in the samples was *Pseudescherichia vulneris*. This species has been shown to cause infection in immune suppressed humans and could be a cause for concern in areas where humans and waterfowl interact.

Engineering & Engineering Technology
Chair: Dr. Adel Salama

No presentations are scheduled in this section for this meeting

Geology & Geography
Chair: Dr. Thomas Byl

12:00 pm – 1:05 pm

12:00-12:05 Business Meeting

12:05-12:20 Biotic traces on the fossil *Mellita* from the Waccamaw Formation, Pleistocene, South Carolina. ***Michael A. Gibson***, *University of Tennessee at Martin, Martin, Tennessee*. The Vanderbilt Fossil Collection, reposited at UT Martin, contains a large collection of fossils from the lower Pleistocene Waccamaw Formation of northeastern South Carolina, that were collected by L.C. Glen sometime in the late 1940s. Echinoids are a prominent part of this collection, including several species within the genera *Encope* and *Mellita*, with the clypeasteroid *Mellita caroliniana* is the most abundant species in the collection. Nearly 20% of the specimens show light to heavy endosclerobiont activity typified by narrow slit-like openings into the aboral surface of the carapace. Individual slits are 1-3 mm in length and concentrate along plate edges where the plates are narrowest and less calcified. Most *Mellita* carpaces have borings concentrated around the ambulachra margins, suggesting a *syn-vivo* occurrence that possibly represents parasitism of the echinoid host. Based upon size, shape, and location of the borings, the burrowing organism is interpreted to be a boring ctenostome ectoproct or boring cirriped arthropod.

12:20-12:35 Characterizing the pigments in lampenflora in Mammoth Cave National Park, Kentucky. ***Nakana'ela Morton*, Sudipta Rakshit, Rickard Toomey, De'Etra Young, Thomas Byl***, *Tennessee State University, Nashville, Tennessee (NM, SR, DY, TB), Mammoth Cave National Park, Kentucky (RT), U.S. Geological Survey, Nashville, Tennessee (TB)*. Algae have adapted to live in a variety of terrestrial environments, even in the cave passages at Mammoth Cave National Park. Previous studies identified the lampenflora growing near the electric lights in the cave were cyanobacteria and chlorophyta. The objective of this research was to characterize photosynthetic adaptation of the cave lampenflora colonies to extremely low light levels. A dual-channel fluorescence-based sensor determined cyanobacteria pigments were more prevalent in the lampenflora than chlorophyta pigments. Spectrophotometric scans (400-800 nanometers) confirmed the presence of phycoerytherin, phycocyanin and chlorophyll pigments. Thin layer chromatagraphy indicated unique photosynthetic pigments in the lampenflora compared to similar algae growing on surface rocks. Cave cyanobacteria appear to have adapted their photosynthetic light harvesting antennae to improve photon capture between the blue and red regions of the spectrum that are not efficiently trapped by chlorophyll found in surface algae, thus, enabling them to capture a broader light spectrum.

12:35-12:50 Response of Mammoth Cave cyanobacteria to ultraviolet light. ***Thomas Byl, Shakarah Nelson, Rickard Toomey III, Benjamin Miller, De'Etra Young***, *Tennessee State University, Nashville, Tennessee (TB, SN, DY), Mammoth Cave National Park, Kentucky (RT), U.S. Geological Survey, Nashville, Tennessee (BM, TB)*. Fossil evidence indicates cyanbacteria were prolific in the Precambrian lakes, rivers and oceans 3.5 billion years ago and helped to give rise to the oxygen-rich atmosphere. Microcystis, Oscillitoria, Leptolyngbya, Planktothrix, Nostoc, Dolichospermum and Hapalosiphon are cyanobacteria that have adapted to grow near tour lights in cave passages at Mammoth Cave National Park. Ten of 11 algae cave-sites tested positive for microcystin making them a nuisance and potential hazard. The objective of this research was to determine if germicidal ultraviolet (UV) light exposure would kill or inhibit the algae. The UV treatment reduced photosynthesis efficiency as measured by quantum yield of photosystem II, but had little effect on pigment fluorescence. The UV irradiation also caused a rapid increase in peroxidase activity, an indicator of oxidative stress. After a 2-week lag time, cave algae exposed to 2 minutes of UV were able to grow in the lab.

12:50-1:05 Correlations between microcystin toxin and environmental variables in the Tennessee State University wetland. ***Brittaney Hogan*, Jacob Byl, Rodney Blackwell, Jr., De'Etra Young, Thomas Byl***, *Tennessee State University, Nashville, Tennessee (BH, RB, DY, TB), Western Kentucky University, Bowling Green, Kentucky (JB), U.S. Geological Survey, Nashville, Tennessee (TB)*. Cyanobacteria capable of producing dangerous microcystin toxins flourish in the Tennessee State University wetland, Nashville, Tennessee. The objective of this research was to measure microcystin and water chemistry to determine trends. Multiple samples were collected from the wetland between June 2017 through January 2020 and analyzed for nitrogen, phosphorous, iron, sulfur, turbidity, and microcystin. Microcystin concentrations ranged from less than 0.15 to 25.1 µg/L. Correlations were run using the environmental variables and microcystin concentrations to determine which variables best predicted elevated microcystin. The environmental variables that predicted microcystin were: turbidity, with an increase in probability of 0.002 for increases in turbidity (significant at 1%); total phosphate, with an increase in probability of 0.045 for each additional milligram per liter (significant at 1%); and the nitrate-to-phosphate ratio, with a decrease in probability of 0.0087 for each increase of 1 in the ratio (significant at 10%).

Health & Medical Sciences
Chair: Dr. Aliyar Fouladkhah

12:00 pm – 12:50 pm

12:00-12:05 Business Meeting

12:05-12:20 Reducing the *L. monocytogenes* infection risk by utilization of nisin and elevated hydrostatic pressure. ***Sabrina Wadood* and Aliyar Cyrus Fouladkhah***, *Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37209, USA*. *L. monocytogenes* is a Gram-positive pathogen of public health concerns that could infect children and adults of all ages. Infection with this bacterium is particularly concerning during pregnancy as pregnant women are nearly 10 times more likely to develop health complications when exposed to this pathogen. Our study investigated effects of nisin to augment pressure-based inactivation of this pathogen. Nisin alone at 5000 IU was not able ($P \geq 0.05$) to reduce the inoculated pathogen. Hydrostatic pressure alone at 350 MPa had limited ($P < 0.05$) efficacy for decontamination of the pathogen. Combination of nisin and 350 MPa pressure resulted ($P < 0.05$) in 2 to 5 log reductions of *L. monocytogenes* i.e. 99 to 99.99% reduction of the microorganism. Our results indicate that stakeholders of this emerging technology could benefit from utilization of nisin coupled with elevated hydrostatic pressure for further preventing the risk of infection with this ubiquitous pathogen.

12:20-12:35 Synergism of thymol, mild heat, and elevated hydrostatic pressure for inactivation of Shiga toxin-producing *Escherichia coli* O157: H7. ***Sadiye Aras*, Shahid Chowdhury, and Aliyar Cyrus Fouladkhah***, *Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37209, USA*. Various serogroups of pathogenic *Escherichia coli*, including Shiga toxin-producing *Escherichia coli* O157:H7 are important public health challenges. Infectious with these serogroups could lead to systematic infection and Hemolytic Uremic Syndrome (HUS), a rare but potentially fatal kindly complications. Children under the age of five are particularly susceptible for developing HUS if exposed to the pathogen. Our study investigated effects of a novel and natural bactericidal in presence of mild heat and elevated hydrostatic pressure for preventing the multiplication of this opportunistic pathogen of public health concern in abiotic reservoirs. Our study indicates that with an optimized application of thymol and elevated pressure, >99% of this pathogen could be inactivated in an abiotic vehicle.

12:35-12:50 Formation of biofilm and survival of wild-type and pressure-stressed pathogens of public health concern in surface water and on abiotic surfaces. ***Niamul Kabir*, Shahid Chowdhury, and Aliyar C. Fouladkhah***, *Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37209, USA*. Safety of water supplies had been a persisting public health challenge. In the current study, persistence of wild-type and pressure-stressed Shiga toxin-producing *Escherichia coli* O157:H7, *Listeria monocytogenes*, and non-typhoidal *Salmonella enterica* serovars in surface water stored aerobically at 5, 25, and 37 °C for up to a month was investigated. Biofilm formation of *Salmonella* serovars on abiotic surfaces were additionally investigated. Under the conditions of our experiments, we observed a prolonged persistence of *L. monocytogenes*, Shiga toxin-producing *E. coli* O157:H7, and non-typhoidal *Salmonella* serovars in surface water during the 28-day trials. Non-typhoidal *Salmonella* serovars additionally exhibited the capability to form and maintain biofilm masses on the surface of rubber and stainless steel. These findings highlight the importance of preventive measures such as those articulated under the. U.S. Food Safety Modernization Act to assure the public health against waterborne diseases.

History of Science
Chair: Dr. Martin V. Stewart

No presentations are scheduled in this section for this meeting

Math and Computer Science
Chair: Dr. Daniel Mayo

12:00 pm – 12:35 pm

12:00-12:05 Business Meeting

12:05-12:20 Measuring gerrymandering: improving upon the efficiency gap. ***Holly Abrams* and Brad Fox***, *Austin Peay State University, Clarksville, Tennessee*. Gerrymandering is the prominent issue of drawing voting district boundaries in a way that favors one political party over another. It has been an issue since 1812, and in recent history, the US courts have relied heavily on a fairly simple calculation called the efficiency gap to determine if districts have been unfairly drawn. However, the simplicity of the efficiency gap indicates a clear lack of consideration for other political factors, leading mathematicians to seek more advanced metrics to identify gerrymandering. In this presentation, we will discuss an early version of a new metric that will take into consideration the amount of seats won by the winning party compared to the total votes cast for that party, but also favor more competitive districts.

12:20-12:35 An asymptotic method for pricing options under Heston model. ***Ibukun Amusan***, *Austin Peay State University, Clarksville, Tennessee*. This paper will examine the problem of option pricing under stochastic volatility. We consider the pricing under the Heston model, which uses a CIR process for stochastic volatility. The Heston model has a closed-form formula for pricing European call options. There are some known problems in implementing the formula, although some methods have been proposed for fixing some of these problems. In this paper, we discuss an asymptotic method that provides an approximate formula for the pricing problem using the CIR process for stochastic volatility. The approximate formula is easier to implement than the Heston formula. We also present some numerical results.

Microbiology
Chair: Dr. Sergei Markov

12:00 pm – 1:05 pm

12:00-12:05 Business Meeting

12:05-12:20 Host range specificity and genomic analysis of Actinobacteria phages. ***Ava Brittain*, Tessa Cote and Jenna St. Pierre***, *Columbia State Community College, Columbia, Tennessee*. Bacteriophages (phages) have been of interest to scientists because they can efficiently destroy bacteria, presenting promising potential for phage therapy. Our objective was to isolate novel bacteriophages, analyze their host range specificity and genomic characteristics. We isolated several phages from soil using the bacterial host *Microbacterium foliorum*. The host-range assays were performed on isolated bacteriophages using *Gordonia rubripertincta* and *Arthrobacter globiformis*. All three selected hosts belonged to the phylum Actinobacteria. Phage morphology was determined by transmission electron microscopy. Phage cultures, analyzed by spot essay, exhibited the lytic mechanism of infection, killing their bacterial host within 24-48h. The genes responsible for the lytic cycle were compared utilizing Phamerator mapping of phage genomes. Our study revealed significant similarity between the lytic genes within the phage cluster and a high phage specificity to the *Microbacterium foliorum* host.

12:20-12:35 Prevalence and spatial variation of antimicrobial resistant commensal bacteria in poultry and cattle farms. ***Maureen Nzomo*, Agnes Kilonzo-Nthenge, Abdullah Ibn Mafiz and Samuel Nahashon***, *Tennessee State University, Nashville, Tennessee*. Antibiotic resistance is an impending public health crisis. Animal production systems play a vital role in the dissemination of antimicrobial microbial resistance (AMR). This study investigated the prevalence and spatial variation of resistant bacteria from animal farms in Tennessee and Alabama. Biochemical tests, Kirby-Bauer test, and Geographic Information System (GIS) were applied for bacterial identification, AMR, and generation of hotspots maps, respectively. The most prevalent bacteria were *Enterococcus* (52.4%), followed by *Klebsiella* (33.6%), and *Escherichia coli* (16.5%). AMR was significantly ($P < 0.05$) higher in vancomycin (100%), azithromycin (79.6%), doxycycline (57.4%), cefixime (43.5%) as compared to erythromycin (22.7%), imipenem (7.4%), meropenem (4.1%), and ampicillin (2.3%). Hotspot maps representing spatiotemporal antibiotic resistance patterns showed that *Enterococcus*, *Escherichia coli*, and *Klebsiella* were resistant to 2, 3, 4 antibiotics, respectively. Cattle and poultry farms are sources of AMR. Hotspot maps from this study will educate producers on the mitigation of antimicrobial resistance.

12:35-12:50 Evaluation of lysine requirements for *Lactobacillus reuteri*. ***Thyneice Taylor-Bowden* and Samuel Nahashon***, *Tennessee State University, Nashville, Tennessee*. In poultry, lysine is the second limiting amino acid needed for breast muscle development which makes it an essential feed-additive. The lack of lysine can cause immunodeficiency in chickens; however, the excess use of lysine decreases potassium concentrations and poor nitrogen retention.. *Lactobacillus reuteri* is a gut bacterium for humans, chickens, and other mammals was identified and selected as an in vitro model to show various concentrations of lysine may alter chicken microflora. Observing Lactobacillus reuteri's ability to thrive and survive various amounts of lysine will provide preliminary data and basis for the 16s metagenomics study. Therefore, we hypothesize that various concentrations of lysine will alter the microflora of broiler chickens due to response and adaptation to the amount and availability of lysine utilized from the diet. 16S metagenomics will reveal microbial profiles of varying concentrations of lysine effect on broiler chicken microflora.

12:50-1:05 Carbon dots as a novel tool for delivery of foreign DNA and microbial transformation. ***Anju Pandey*, Asmita Devkota, Korsi Dumenyo and Ali Taheri***, *Tennessee State University, Nashville, Tennessee*. Most common DNA delivery systems in bacteria include artificial transformation through heat shock and electroporation. The use of nanoparticles as an alternative in an effort to deliver plasmid is also gaining popularity, however their use in microbial cell transformation has not been reported yet. Here we are reporting the synthesis and use of four different carbon dots (CDs) in delivery of plasmid DNA inside the cells including. CDs were fabricated using microwave and hydrothermal synthesis. A plasmid carrying ampicillin resistance gene was used as a selectable marker in our transformation and further confirmation was carried out using PCR amplification of a plasmid fragment using M13Forward and M13Reverse primers. Our findings indicate that CDs can be used successfully as an alternative method in delivery of foreign DNA inside *E. coli*. The efficiency of these carbon dots is not as high as a heat shock approach and still needs further optimization.

Physics & Astronomy
Chair: Dr. Mary Kidd

12:00 pm – 12:50 pm

12:00-12:05 Business Meeting

12:05-12:20 Astronomical spectroscopy from a small campus observatory, teaching and research. ***Gary D. Henson***, *East Tennessee State University, Johnson City, Tennessee*. The acquisition of a medium resolution spectrograph, mounted to a 0.35 meter telescope, has greatly expanded the observational astronomy experience for students in the department's astronomy minor as well as for majors interested in astronomy research. In addition, students contribute to science by acquiring spectra of Be type stars with the spectra submitted to an archive of such observations for researchers. Although astronomical imaging and photometry have long been undertaken by undergraduate students, spectroscopy is a much more powerful tool for research and the dominant observational methodology for modern astronomy. We present the details of the spectrograph and the exposure of students to its operation and to the data reduction process in our current program.

12:20-12:35 CCD sequences in the field of Dolidze-35. ***J. Allyn Smith and Jamin E. Welch***, *Austin Peay State University, Clarksville, Tennessee*. We present CCD-based sequences of stars which are useful as secondary photometry standards in the field of the open cluster Dolidze-35. Data exist for three different filter sets from our work, and additional filters using existing data bases. These stars span a range of brightness and color. We present the non-ISR corrected magnitudes as these are the comparisons which are used during observing.

12:35-12:50 Dielectric elastomer actuators: impact of foam tape density on flexibility and feasibility of future prosthetics. ***Lydia R. Guertin****, *Fred J Page High School, Franklin, Tennessee, and Middle Tennessee State University, Murfreesboro, Tennessee*. In light of the expanding field of medical soft robotics and the need to replicate more accurately the fluidity of human motion in prosthetic tissues, researchers have begun exploring dielectric elastomer actuators as a possible replacement for the current prosthetic technological failures. This paper explores the structural support failings of current models of actuators and posits the use of a similar dielectric tape, VHB 5952, in the fashion of current experimental research on VHB tapes. While this tape significantly increases structural support and reduces the potential for tearing in the prosthetic tissue, it is found to be incompatible with the low voltage

requirements of a mechanism working in the human body. The conclusion reached of the impossibility of VHB 5952 is used to recommend a possible middle ground between the industry standard of VHB 4910 and increased structural integrity to advance the field of prosthetic engineering.

Science and Math Teaching
Chair: Dr. Lisa Sullivan

12:00 pm – 12:50 pm

12:00-12:05 Business Meeting

12:05-12:20 Implementing epidemiology into the secondary science classroom. ***Zachary Warren*, Esther Frimpong*, Anant Godbole, and Megan Quinn***, *East Tennessee State University, Johnson City, Tennessee*. The purpose of this presentation is to present a case for the value of teaching epidemiology concepts in high school as well as suggest methods for appropriately implementing the concepts into the science curriculum. In May-June 2020, the ETSU Governor's School on Biology and Statistics focused on COVID-19 data sets. Research has shown that teaching epidemiology to high school students can increase critical thinking skills, raise awareness of a crucial and ever-growing career field, and encourage students to be lifelong learners. Unfortunately, constantly-shifting and demanding science standards make the implementation of epidemiology difficult, and many teachers lack the training necessary to teach epidemiology. This presentation will provide an overview of the benefits and viability of implementing epidemiology in the high school curriculum as well as serve as a rudimentary framework for training teachers in using epidemiology to implement 3D science practices in their classrooms across a variety of subjects.

12:20-12:35 Where they are and where you want to lead them: guiding biology students in their first semester of college. ***Jennifer T. Thomas***, *Belmont University, Nashville, Tennessee*. The science of learning has long contributed to our understanding of how the human brain acquires knowledge. In recent decades, this research has guided professors in developing teaching approaches, far beyond traditional lecturing, that lead to meaningful learning for their students. While the transitions to college are numerous, none can be as challenging for the average student than the shift to this independent, application-based, and analytical learning; students often find that they are not prepared to succeed with the skills they have practiced. Based on qualitative and quantitative data from students, I have developed a step-wise approach using strategies in the areas of retrieval practice, interleaving, and self-explaining for students in three broad categories: students with poor content background, students who rely on note-taking, and students lacking emotional intelligence skills. With feedback from the student and a strategic plan, students can gradually improve and gain a foundation for future success.

12:35-12:50 Using COVID-19 statistics to reinforce mathematical modeling for method of initial rates. ***Marcia M. Schilling***, *Austin Peay State University, Clarksville, Tennessee*. In the spring of 2020, mitigation efforts to limit the spread of COVID-19 resulted in a sudden shift in modality of instruction for biochemistry lab students in the medical laboratory scientist professional track. Having completed an exercise in enzyme kinetics two weeks prior to convening online, the statistics of COVID-19 cases per country were used as an exercise in graphical modeling that resembled aspects of the method of initial rates. The exercise gave future hospital lab personnel and experience in epidemiological prediction while reinforcing commonly used mathematical data treatments used in kinetic analysis.

Zoology
Chair: Dr. Barbara Shock

12:00 pm – 1:35 pm

12:00-12:05 Business Meeting

12:05-12:20 Do families break the scale? An allometric scaling analysis of carnivora. ***Stefanie Navaratnam* and Julie Baker Phillips***, *Cumberland University, Lebanon, Tennessee*. Analysis of scaling relationships, allometric scaling, has a long history of importance for modeling and predicting biological phenomena. Individual organisms are not truly independent, and as a result phylogenetic corrections are necessary to increase the accuracy of scaling relationships. These scaling relationships are thought to disappear at certain taxonomic levels, but research at these lower levels had limited data and relationships were not corrected with phylogenetic analyses. In the current work, we investigate if using a supertree in combination with additional gestation and body mass data supports the hypothesis that scaling relationships do not exist at the Family taxonomic level. Using a Carnivora supertree, we perform a phylogenetically generalized least squares (PGLS) analysis on the Pantheria dataset. Our data suggests that at the Family taxonomic level allometric relationships are maintained in Canidae, Felidae, Herpestidae, and Mustelidae while not in other families.

12:20-12:35 Response of foraging birds to playback of calls from a non-bird eating hawk and a bird eating hawk at feeding stations in northwest Tennessee. ***William J. Harrison*, Julian A. Echols*, and H. Dawn Wilkins***, *University of Tennessee at Martin, Martin, Tennessee*. Reacting to sounds that are not a threat wastes time and energy. Our goal was to determine if wintering birds visiting feeding stations were more likely to flush upon playback of calls from a non-bird eating hawk (Red-tailed Hawk, *Buteo jamaicensis*) as compared to calls of a bird eating hawk (Cooper's Hawk, *Accipiter cooperii*). We allowed feeders to populate with birds before we played hawk calls. We counted the number of individuals of each species before and after playback. Overall, the mean number of birds was significantly lower after the playback of Cooper's Hawk calls as compared to before playback. This drop in the number of birds did not occur after the playback of Red-tailed Hawk calls. White-throated Sparrows (*Zonotrichia albicollis*) and American Goldfinches (*Spinus tristis*) reacted to Cooper's Hawk calls more strongly than Northern Cardinals (*Cardinalis cardinalis*) and Pine Siskins (*Spinus pinus*) suggesting that species may respond differently.

12:35-12:50 Descriptive analysis of the cellular organization of the mesoglea in the symbiotic anemone, *Exaiptasia pallida*, using light and fluorescence microscopy. ***Joshua Hubbuch* and Shanna Hanes***, *Martin Methodist College, Pulaski, Tennessee*. Little is understood of the nature, function, and contents of the interstitial layer called the mesoglea found in all diploblastic cnidarians. The mesoglea has been previously defined as a collagenous matrix which provides a form of collapsible support for the cnidarian, allowing it to shrink and expand when tactile stimulus is felt by its primitive nervous system called the nerve net. This descriptive study aims to locate and identify the cellular components within each tissue layer in the common anemone, *Exaiptasia pallida*, using fluorescence and light microscopy with emphasis placed on the composition and function of the mesoglea. These findings will contribute to our understanding of how the mesoglea functions and what role it plays within the cnidarian.

12:50-1:05 On flower inspection and the tactile sensitivity of a long proboscis. ***Benjamin Allen*, Jacob Zielke*, Buskin Barnes*, Emily Hudgins*, and Joaquín Goyret***, *The University of Tennessee at Martin, Martin, Tennessee*. *Manduca sexta* are large, nocturnal-crepuscular hawkmoths that forage on nectar by hovering in front of a flower at a steady distance while probing the corolla with their long, thin proboscis.

Upon tactile detection of floral features such as grooves, moths display a conspicuous behavior, where they run their proboscis through it with a back and forth pattern. We use this behavior as a proxy for tactile detection of grooves. We used 3D printed discs as surrogate flowers with varying groove sizes (1 mm, 0.1 mm, 0.05 mm, and 0 mm) to determine the resolution of their proboscis. What we found is that moths detected grooves as small as 0.1 mm but not 0.05 mm. We are now repeating the experiment with a clear acetate film on top of the 1 mm disc, which would allow visual, but not tactile detection, to control for any putative visually guided response.

1:05-1:20 Adaptive seasonal shift towards investment in fewer, larger offspring: Evidence from field and laboratory studies. ***Joshua M. Hall, Timothy S. Mitchell, Christopher J. Thawley, James T. Stroud, and Daniel A. Warner***, *Auburn University, Auburn, Alabama (JMH, DAW), University of Minnesota, St. Paul, Minnesota (TSM), Neumann University, Aston, Pennsylvania (CJT), and Washington University, St. Louis, Missouri (JTS)*. Two hypotheses attempt to explain seasonal changes in the size and number of offspring: 1) an adaptive hypothesis whereby early offspring have a survival advantage over those produced later and 2) a passive hypothesis whereby seasonal changes in the maternal environment result in these changes. To test these hypotheses, we performed a laboratory study that controlled maternal environments and quantified reproductive patterns throughout the reproductive season for female lizards (*Anolis sagrei*), and a field study that measured similar metrics from free ranging lizards. In the lab, smaller eggs were laid earlier, larger eggs were laid later in the reproductive season. Because these patterns emerge under controlled conditions, they likely represent an intrinsic, adaptive adjustment of reproductive effort as predicted by life-history theory. The field study revealed similar trends, indicating that intrinsic patterns observed in the laboratory are strong enough to persist despite the environmental variability that characterizes natural habitats.

1:20-1:35 One Health biomonitoring for synanthropic blood-feeding flies atop Tennessee's Cumberland Plateau. ***David Bruce Conn and Denise Andriot Conn***, *Berry College, Mount Berry, Georgia (DBC), Harvard University, Cambridge Massachusetts (DBC), and NASCENT, Monteagle, Tennessee (DBC, DAC)*. Several families of the insect order Diptera include nuisances and disease vectors of medical and veterinary importance. Some are synanthropic, living in human activity areas. We surveyed a single dry upland site in Monteagle, near residences but away from major water bodies. From May-October 2020 we deployed CDC and BG-Sentinel traps, but emphasized Human-Landing-Catches to target synanthropic adult vectors. We sampled mosquito larvae from water in small artificial containers. Three fly families were common. Water-breeding mosquitoes (Culicidae) primarily included native tree-hole breeders, *Aedes triseriatus* and *Aedes hendersoni*, and alien invasive container-breeders, *Aedes albopictus* and *Aedes japonicus*; larvae of the latter were collected from flower pots. Soil-breeding phlebotomine sand flies (Psychodidae) collected were *Lutzomyia shannoni*. Wet-breeding biting midges (Ceratopogonidae), reported for the first time from this site, included abundant *Culicoides* species still being identified. All groups commonly landed on human subjects and thus pose potential threats of pathogen transmission.

Poster Presentations

Agriculture Posters

Agriculture Section 1 (Plant Science/Geoscience)

08:30-08:35

1-01 Integration of alternative strategies to optimize *Phytophthora* Root Rot (*Phytophthora cinnamomi*) management in flowering dogwoods (*Cornus florida*) under flooding condition. ***Krishna Neupane*, Vivek Ojha, Jason B. Oliver, Karla M. Addesso and Fulya Baysal-Gurel***, *Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, Tennessee*. Flowering dogwood trees (*Cornus florida* L.) are prone to *Phytophthora* root rot when flooded. In this study, 7 different treatments (combination of 3 products: Subdue MAXX, permethrin and blocking agent X + kaolin) were evaluated on containerized dogwood trees artificially inoculated with and without *Phytophthora cinnamomi*. Subdue MAXX was drench applied preventatively 21 days before flooding, while permethrin and blocking agent X + kaolin was sprayed over the trunks 1 day before flooding and 2 days after flooding, respectively. The trees were flooded for 21 days. At the end of the trial, plant growth data were recorded, and roots were assessed for disease severity using a scale of 0-100% roots affected, as well as plated on PARPH-V8 medium to determine the percentage of *Phytophthora*-infected root samples. Combination of Subdue MAXX and Permethrin was able to significantly suppress the disease in both inoculated and non-inoculated trees as compared to inoculated controls.

08:35-08:40

1-02 The impact of white-tailed deer (*Odocoileus virginianus*) on growth and yield components of soybean (*Glycine max*) in northwest Tennessee. ***Sydney C. Baker* and Barbara A. Darroch***, *University of Tennessee at Martin, Martin, Tennessee*. White-tailed deer are prevalent soybean pests in west Tennessee and can reduce soybean yield. The objective of this study was to quantify the effects of deer browsing on plant height, canopy cover, and yield components of soybean. As expected, soybean plants that had been eaten by deer were shorter than uneaten plants ($P < 0.05$) in July and early August, but plants recovered by the end of August and no height difference was observed thereafter. Percent canopy cover was also reduced by deer browsing; canopy cover in July was lower where deer had browsed ($P < 0.05$) but the differences were no longer significant by the end of July. Yield components will be determined at harvest to see if deer browsing had lasting impacts on soybean plants.

08:40-08:45

1-03 Evaluation of cowpea growth and development for two cultivars in Middle Tennessee. ***Sydney Holbert*, Donald Sudbrink, and Tiffany Carter***, *Austin Peay State University, Clarksville, Tennessee*. As the global population continues to increase, the demand for food production also continues to increase. Cowpea, (*Vigna unguiculata*), varieties offer a viable food source packed with protein, starch, and fiber that can be produced in a variety of environments and scales from garden plots to large fields. The objective of this study was to evaluate the growth and development of two cowpea cultivars (whippoorwill southern peas and pinkeye purple hull peas) in a Middle Tennessee environment. The pink eye purple hull cultivar was observed to grow more rapidly in plant length and in development of the number of nodes than the whippoorwill cultivar. These Middle Tennessee results reflect similar results from maturity studies conducted in other regions. This study serves as a preliminary study for future research in the area of cowpea growth and development in Middle Tennessee.

08:45-08:50

1-04 An evaluation of three sisters corn production systems at two locations in Middle Tennessee. ***Andrew Bohringer*, Donald Sudbrink, and Tiffany Carter***, *Austin Peay State University, Clarksville, Tennessee*. The "Three Sisters" is an indigenous agricultural system that includes growth of Corn, Beans, and Squash within mounds. For several years, researchers at Austin Peay State University (APSU) in Clarksville, TN have grown an indigenous corn cultivar (Cherokee White Eagle) in a three sisters system. Dunbar Cave State Park (DCSP), also in Clarksville, recently began to grow three sisters corn. The objective of this study was to contrast the performance of the corn grown in the APSU garden with the corn grown at the DCSP garden. The APSU grown corn entered the VT stage "tasseling" at 41 Days after planting and then began the R1 "silking" phase at 46 DAP. The corn at DCSP reached tasseling stage significantly later and didn't form viable ears. The APSU corn tasseled more rapidly and produced more ears due to full exposure to sunlight that was not as readily available at the DCSP site.

08:50-08:55

1-05 Efficacy of fungicides and biofungicides in controlling root and crown rot disease of woody ornamental plants caused by *Phytopythium vexans*. ***Madhav Parajuli*, Milan Panth, and Fulya Baysal-Gurel***, *Tennessee State University, McMinnville, Tennessee (MP, FBG) and Clemson University, Blackville, South Carolina (MPant). Phytopythium vexans* is a soilborne plant pathogen recently identified causing root and crown rot in woody ornamentals. The field efficacy trial using fungicides, biofungicides, fertilizer and host plant defense inducers was conducted to control *Phytopythium* root and crown rot in ginkgo and maple plants. Plant height, plant fresh weight and root fresh weight were recorded, and plant roots were assessed for disease severity using a scale of 0 to 100 % roots affected. There were no significant differences in plant height, plant fresh weight and root fresh weight among the treatments at the end of the trial. Segovis, Subdue MAXX, Pageant, Empress and RootShield PLUS+ in maple, and all fungicides and RootShield PLUS+ in ginkgo significantly reduced the pathogen severity compared to the non-treated, inoculated control. These results will be helpful to nursery growers in making decision on the management of *Phytopythium* root and crown rot disease of nursery crops.

08:55-09:00

1-06 Dip application of sanitizers in managing postharvest Volutella blight in boxwood cuttings. ***Ravi Bika*, Teri Simmons, Christina Jennings, and Fulya Baysal-Gurel***, *Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, Tennessee*. *Pseudonectria buxi*, which cause Volutella blight, is problematic pathogen of boxwood greenery market, often causing significant economic loss to all postharvest chain (producer-retailer). The pathogen- *P. buxi*, can be transferred from one place to another (long-distance) via transportation of infected plant materials, if they are not properly treated. The objective of this study was to identify effective sanitizer for the management of postharvest Volutella blight disease in harvested boxwood cuttings. All treatments significantly reduced the postharvest Volutella blight disease severity and disease progress (AUDPC) compared to non-treated inoculated control; however, Simple green d pro 3 plus, Simple green d pro, KleenGrow, alcohol, and Lysol (all-purpose) were the most effective treatments in reducing the disease severity and disease progress. These five treatments also most significant in maintaining the longer postharvest shelf life of boxwood cuttings. This study will help growers make their decision about sanitizers to use for postharvest disease management.

09:00-09:05

1-07 Brown marmorated stink bug and kudzu bug abundance in soybeans. ***Kaushalya Amarasekare and Richard Link***, *Tennessee State University, Nashville, Tennessee*. Exotic invasive pest arthropods pose a serious threat to crop production. Brown marmorated stink bug *Halyomorpha halys* (Hemiptera: Pentatomidae) and kudzu bug *Megacopta cribraria* (Hemiptera: Plataspidae) are two invasive pests that are currently found in Tennessee and pose a threat to soybeans. To assess the seasonal abundance of

these two pests in soybeans, we conducted a field study in 2016 and 2017 in Nashville and 2016 in Ashland City. We used lures and sweep sampling to monitor *H*. *halys* and sweep sampling to monitor *M. cribraria*. Results show a low abundance of both species. Significantly higher number *of H. halys* and *M. cribraria* were found in Nashville in 2016 than in Ashland City in 2016 or Nashville in 2017. *Halyomorpha halys* started to appear in mid-August and increased their numbers in early to mid-September. In contrast, *M. cribraria* started to appear in late July and their population increased in September.

09:05-09:10

1-08 The application of climate data in research for the mass population. ***Montana Wright* and Rachna Tewari***, *The University of Tennessee at Martin, Martin, Tennessee*. Climate data is critical to conducting appropriate scientific research to allow stakeholders to make informed agricultural production decisions under a changing climate. The relevant use of climate data can also complement educational endeavors for enhancing science literacy, regarding climate and climate variability. This study details the use of climate data in the context of exploration of climatic parameters, navigating data repositories based on research requirements, data selection, and the importance in agricultural practices. In addition, suggestions are offered for climate data formatting for appropriate use in research models and sharing climatic information with relevant users. The need for climate data in agricultural research and the criticality of using the correct format and units is also highlighted. Finally, tools for data procurement from national databases and weather stations as well as techniques for collecting, simplifying, and converting climate data to a usable format for potential use in undergraduate research is examined.

09:10-09:15

1-09 Climate Change Education (CCE): Student experiences from climate data studies, education sessions, and survey analysis. ***Abigayle Sartain*, Rachna Tewari, Mark Simpson, and Joey Mehlhorn***, *The University of Tennessee Martin, Martin, Tennessee*. As part of a federally funded climate change education (CCE) grant, this project describes undergraduate student experiences in studying weather patterns, conducting educational sessions for high school students, and analyzing survey data of college students' perspectives on climate change and its impacts on agriculture. Weather data collected included precipitation, temperature, evaporation, and wind. Educational sessions used a climate change wedge game to encourage 4-H and FFA students to find cost-effective measures to reduce carbon emissions in agriculture. The survey analysis used a Likert scale tool based on the premise of increasing awareness among college students that climate change is impacting agriculture locally and examining their willingness to pay for community-based climate change mitigation efforts. Given the gap in knowledge surrounding climate change, more efforts should focus on education and research in universities, and outreach in rural communities to enhance awareness about climate change and to positively impact future policy regulations.

Agriculture Section 2 (Animal Science, Agricultural Economics, and Agricultural Education)

08:30-08:35

2-01 The effect of soybean hull litter on broiler livability, growth, and behavior. ***Charis Waters*, Jessica Williams, Craig Darroch, and Linda Husmann***, *University of Tennessee at Martin, Martin, Tennessee*. This study evaluated the effects of soybean hull (SB) litter on commercial broiler livability, growth, and behavior. Soybean hulls were compared to rice hulls which are a common litter material in west Tennessee barns. There were two litter treatments: soybean hulls (n=3) and rice hulls (n=3); and 200, day-old broiler chicks were assigned to each pen. The average daily gain (ADG) for 49-day old broilers was 74.9 ± .92 g and final body weight averaged 3820.8 ± 55 g. There were no significant differences in ADG or final body weights between treatments. Livability was 93.2% and there were no differences

(P>0.05) in culls or mortalities between treatments. Broilers raised on SB hulls compared to rice hulls exhibited more dust bathing and scratching behaviors which are indicative of a welfare friendly environment. In conclusion, soybean hulls are a suitable alternative to rice hull litter supporting broiler growth.

08:35-08:40

2-02 Blue growth and developing countries: The role of consumer preference for ecolabels. ***Renu Ojha* and Kar H. Lim***, *Tennessee State University, Nashville, Tennessee*. An ecolabel is a tool developed to control unregulated fishing and maintain the Blue Growth. Seafood from sustainable fisheries has ecolabel. Because seafood trades mostly from developing to developed countries a question arises, "Does ecolabelling benefit the producers of developing countries"? If American consumers are willing to pay (WTP) more for imported eco-labeled seafood, it indicates the ecolabels' potential to generate a premium for the imported products. Consequently, it incentivizes the sustainable producers. We will use the conditional logit model to estimate Americans' preference for Best Aquaculture Practices, Marine Stewardship Council, and Sustainably Sourced certified seafood imported from various developed and developing countries. We are conducting a nationally distributed online choice experiment targeting 2000 samples. We expect that American consumers will show greater WTP for eco-labeled seafood imported from developing countries than developed countries. The policymakers, and private stakeholders can use the finding to decide upon investing on ecolabelling programs.

08:40-08:45

2-03 How do consumers view GMOs vs organic food products? An analysis of perceptions of specific GMO products. ***Greg Nies*, Joey Mehlhorn, Rachna Tewari and Will Bird***, *University of Tennessee at Martin, Martin, Tennessee*. Food safety and quality is garnering more attention than ever, thus fueling the demand for organically grown food. Consumers often believe that organic food is healthier and safer than conventionally grown food. Critics of conventional agriculture practices often question the safety of agrichemicals used in food production. This study sought to identify and describe perceived health and safety concerns of specific GMO products compared to conventionally produced food products. A purposively selected sample (n = 37) completed surveys. Fifty-four percent of the respondents were classified as holding a "misperception" as to the health and safety risks of conventional farming practices, while 27% of the respondents were classified as holding a "misperception" on the health and safety risks of GMO products. Although the generalizability of these results are limited due to sampling procedures, future investigations utilizing more rigorous sampling methods should be conducted to further explore these consumer trends and perceptions.

08:45-08:50

2-04 Utilizing interactive and hands-on teaching techniques in animal science courses. ***Elizabeth Whitt*, Diana Watson, Joey Mehlhorn, and Emalee Buttrey***, *The University of Tennessee at Martin, Martin, Tennessee*. The purpose of this project is to discuss and share four different teaching activities that help students actively engage in learning. Our goal is to share ideas and inspire creative use of readily available supplies to help students achieve a greater depth of learning through active engagement and hands on activities. The four topics of learning in animal science addressed are the reproductive cycle through a group activity, skeletal anatomy by using live farm animals, balancing feed rations using food items and muscle and gastrointestinal tract anatomy using a modeling compound. These techniques utilize educational methods such as kinesthetic learning and visualization which are known to improve soft skills, critical thinking and application. These techniques have been implemented for multiple semesters and continue to show positive results of deeper understanding and retention of material based on student feedback.

08:50-08:55

2-05 A bi-seasonal evaluation of somatic cell counts, hygiene scores, and bedding cultures of Holstein cows housed in a compost bedded pack barn. ***Gabrielle Mould*, Maegan Hollis, and Jessica Carter***, *Middle Tennessee State University, Murfreesboro, Tennessee.* Cows housed on compost bedded pack barns are known to experience reduced somatic cell counts (SCC) compared to other types of housing. This study aimed to evaluate the relationship between SCC, bacterial cultures of milk and bedding, and hygiene scores of cows. Holstein cows (n=18) were monitored for 28 days during fall and spring seasons. Cows were sorted into high (H) and low (L) groups based on SCC. Weekly milk samples were collected, measured for SCC and those testing greater than 250,000 cells/mL were cultured. High cows had lower milk yields (P=0.0001), higher somatic cell scores (P=0.0003) and lower average activity (P< 0.0001) than L cows. Seasonally, cows exhibited lower milk yields in the fall (P<0.0001) while also having higher somatic cell scores (P=0.0003), average activity (P<0.0001) and average rest bouts (P<0.0001). These results insinuate somatic cell score and season affect a cow's productivity and udder health.

08:55-09:00

2-06 Agriculture supply chain and the H-2A visa program. ***Olivia Casada*, Joey Mehlhorn and Rachna Tewari***, *University of Tennessee at Martin, Martin, Tennessee*. By most accounts, U.S. agriculture is facing a labor shortage as people migrate from rural areas. Shortages have become severe in labor intensive crops such as fruit and vegetable production resulting in strained supply chains. The Bracero program was first used in 1942 to help provide 4 million guest workers to assist in U.S. agriculture production. Today this program is known as the H-2A temporary agricultural workers program. As the number of available H-2A visas are allotted each year and the cost of maintaining worker conditions changes it is expected that input costs are impacted. This presentation will focus on how immigration policies impact agriculture production and supply chains. The application process and associated costs of compliance of the H-2A program require producers to have a thorough understanding of the program. Regional impacts are compared as well as possible solutions for managing on farm labor during peak seasons.

09:00-09:05

2-07 Public perceptions of conventional agricultural practices and vaccination recommendations in Tennessee: Preliminary survey results. ***Greg Nies*, Joey Mehlhorn, Rachna Tewari and Will Bird***, *University of Tennessee at Martin, Martin,Tennessee*. An ever-increasing world population requires advances in conventional agriculture to boost production. Yet consumers are exhibiting a preference for "organic" or "all natural" food products. This study attempts to identify the motivating factors behind this anti-science bias in an effort to develop a strategy to combat the problem. A purposively selected sample (n = 37) completed surveys. Results showed that consumers are concerned that information reported on the safety of GMO foods and vaccinations might be skewed. People tend to have a pre-existing view about vaccines and GMOs and are not always open to opposing findings that challenge their views. The current problem is deeper than a simple lack of information. Addressing the values of those consumers hesitant to accept modern agricultural procedures may lead to greater trust in experts, better perceptions of the true safety of conventional agricultural products, and an enhanced perception of modern agricultural practices and products.

09:05-09:10

2-08 Application of electronic nose to analyze volatile organic compounds in hot beverages. ***Latrice M. Cooper* and Ramasamy Ravi***, *Tennessee State University, Nashville, Tennessee*. The flavor of beverages (tea/coffee) is evaluated mainly by its taste and smell, which is composed of hundreds of Volatile Organic Compounds (VOCs) and Non-Volatile Organic Compounds present in beverages. These VOC's are present in different ratios and determine the quality of the beverages. The main objective of

this research is to use the electronic nose technology to finger print the volatile profile and electronic nose mimics an un-biased depiction of the human sensory experience. Literature review indicated that the potential use of electronic nose to analyze volatile organic compounds in hot beverages. In an effort to develop an understanding of temperature effect on the volatile profile on the beverage quality, electronic nose technique has been employed to profile volatiles and also for similarity/ discrimination among the beverage samples. Preliminary results indicated that e-nose is capable of discriminating flavors of tea samples prepared under different processing conditions like temperature.

09:10-09:15

2-09 Equine skeleton reconstruction for use as a high-impact practice at the University of Tennessee – Martin (UTM). ***Savannah Metheny*, Diana Watson, Jason Roberts, Clint Ary, Jack Grubaugh, and Ray Witmer***, *The University of Tennessee at Martin, Martin, Tennessee*. This was a high-impact learning project for a senior veterinary science student consisting of the processes of dissecting, preserving and reassembling a fully articulated equine skeleton. The project also provided current and future students with an experiential teaching modality. This project was a collaborative effort that utilized the expertise of the UTM biology, engineering, and agriculture departments to use dermestid beetle colonies to prepare the bones, design and build a steel support structure and rearticulate the skeleton, respectively. The senior student gained an in-depth knowledge of equine anatomy along with development of critical thinking and problem-solving skills. This eight-month project was successfully completed in June of 2020. The equine skeleton now resides in the Veterinary Health Teaching Facility Anatomy Lab at the University of Tennessee at Martin.

09:15-09:20

2-10 Enhancing students' awareness of their learning styles: reflections from a freshman agriculture course. ***Isaac Lepcha* and Rachna Tewari***, *The University of Tennessee Martin, Martin, Tennessee*. An assessment of student learning styles can provide valuable insights on how students process information and how instructors can modify their teaching techniques to enhance student learning. Past studies in agricultural colleges have examined learning style variations among student populations, however, literature is scarce for studies exploring the effectiveness of different teaching tools for specific learning styles. With advancements in technology-enabled teaching methodologies and the growing use of virtual teaching interfaces, instructors can explore novel and interesting digital avenues to complement their teaching, especially as they gauge different learning styles within their classrooms. This study attempted to examine the effectiveness of different teaching tools for specific learning styles among students in a freshman agriculture course. Student performance was evaluated for each learning activity in the context of their unique learning styles. Such classroom experiments can foster student learning and enable instructors to tailor instruction to students' individual learning styles.

09:20-09:25

2-11 Teaching strategies for connecting with students: Lessons from the sciences and social sciences. ***Isaac Lepcha, Rachna Tewari, Sandy Mehlhorn, and Joey Mehlhorn***, *University of Tennessee at Martin, Martin, Tennessee*. Agriculture is a diverse area of study requiring a variety of techniques to convey information to students. Traditionally, disciplines like plant sciences and engineering rely heavily on visual and kinesthetic learning tools, while agribusiness leans on auditory learning techniques. Normally, disciplines are free to choose the appropriate delivery method, however the recent pandemic has forced the virtual delivery of educational content across all areas. This presents a challenge to faculty in conveying materials in a way that best suits the students' learning style. This study highlights online teaching and learning experiences among faculty and students in the context of students' primary learning style. Digital learning objects (DLOs) such as audio-visuals, virtual labs, and equations had to be employed quickly in non-business areas. The agribusiness faculty transitioned swiftly due to pre-

developed voice lectures primarily addressing auditory learning. Suggestions for catering to different learning styles across various agriculture disciplines are also discussed.

Botany and Cell & Molecular Biology Posters

08:30-08:35

3-01 Nitrogen limits growth of a green alga due to phosphorus saturation in a Middle Tennessee stream. ***Jefferson G. Lebkuecher and James M. Mauney****, *Austin Peay State University, Clarksville, Tennessee*. Water was sampled 1 km upstream of the Cookeville Wastewater Treatment Plant discharge into Pigeon Roost Creek (PR upstream) and 2 km downstream (PR downstream). Water at the PR-downstream site had > 7-fold higher [total phosphorus] (193 µg/L), yet < 1.5-fold higher [total nitrogen] (1900 µg/L) relative to the PR-upstream site. Phosphorus (P) and nitrogen (N) additions to growth assays using the unicellular green alga *Raphidocelis subcapitata* indicate carrying capacity was P limited in water from the PR-upstream site. Carrying capacity was significantly greater and N limited in water from the PR-downstream site. The results indicate reduction of the total N to total P ratio of Pigeon Roost Creek changed the nutrient that limits carrying capacity for *R. subcapitata* from P to N. The results also imply that standard growth assays may not indicate the extent of the impact of P enrichment to a watershed due to N limitation of carrying capacity.

08:35-08:40

3-02 Addressing the potential role of bioactive compounds in the prevention of COVID-19 by targeting specific proteins through molecular docking and experimental studies. ***Brahmaiah Pendyala, Ankit Patras, and Chandravanu Dash***, *Tennessee State University, Meharry Medical College*. COVID-19, is an ongoing pandemic of coronavirus disease 2019, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Studies have reported the following SARS-CoV-2 molecular targets proteins; Main Protease, Papain-lie protease, Nsp3, RdRp, Helicase, Nsp14, Nsp15, Nsp16 etc. It is reported that 3CLpro and PLpro are two proteases that process the polypeptide translation product from the genomic RNA into the structural and nonstructural protein components; vital for the replication and packaging of a new generation of viruses. We hypothesize that natural bioactive compounds can treat COVID-19 alone or in combination with conventional drugs. Our *in silico* studies showed that Phycocyanobilin [PC] and Quercetin [QC] are potent inhibitor bioactive compounds to Mpro, PLpro and RdRp (protein docking studies). In-vitro studies on Mpro & PLpro enzyme activity in presence of bioactive compounds indicated that the PC and QC were efficient inhibitor compounds with IC50 value of 71 µm and 145 µm, respectively.

08:40-08:45

3-03 Twist1b knockout in zebrafish. ***Grace Hurley* and Nikki Glenn***, *Belmont University, Nashville, Tennessee*. The Twist gene is vital in development in various organisms and is needed for survival. The gene family aids in the specialization and differentiation of mesodermal cells. The Twist gene has duplicated into paralogs, with their own functions. Twist1b is a protein-coding gene paralog to the human Twist1 gene. In zebrafish, it is expressed ~6 hours postfertilization. Previous research has attempted to knock out Twist1b completely but failed due to genetic compensation meaning that even when the majority of Twist1b is taken out the gene maintains function through protein feedback loops. This study aims to observe the development of the sclerotome when twist1b is completely knocked out. The CRISPR-cas9 system was used and two guide RNAs were created, using gRNA design from the CHOPCHOP website. The gRNAs were amplified, transcribed, and microinjected into developing zebrafish embryos. This study will inform us of what role(s) Twist1b plays in sclerotome development.

08:45-08:50

3-04 The effects of twist1 and twist2 on sclerotome differentiation into tendon progenitors in zebrafish. ***Marinia Bishay* and Nicole Glenn***, *Belmont University, Nashville, Tennessee*. Somites are important mesoderm structures that form in regularly timed intervals from the anterior end of the paraxial mesoderm at the end of gastrulation during embryogenesis. Cells of the ventromedial portion of the somite, the sclerotome, undergo epithelial to mesenchymal transition, surround the notochord, and give rise to connective tissues of the axial skeleton including the vertebrae, tendons, and ligaments. We are interested in understanding how the sclerotome is compartmentalized into the region that makes tendons. Genes expressed in the sclerotome, twist1 and twist2, are likely involved in the downstream differentiation of sclerotome to become tendon progenitors. Previous studies have shown that Tgf-beta signaling is important for tendon formation. We are investigating how knockdown of twist1 and twist2 affects Tgf-beta expression in early tendon precursors derived from the sclerotome in zebrafish embryos. These studies will elucidate the role twist1 and twist2 play during sclerotome differentiation to tendon cells during embryogenesis.

08:50-08:55

3-05 Effect of activating the endocannabinoid system on zebrafish embryo development. ***Aleya Prasad* and Nikki Glenn***, *Belmont University, Nashville, Tennessee*. Cannabinoids are the most commonly used illicit drugs during pregnancy in the United States. Cannabinoids act upon the endocannabinoid system, which helps regulate physiological factors such as pain, anxiety, movement, appetite. Because they can cross the placental barrier, exposure to cannabinoids can affect the developing fetus. In this study, zebrafish (*Danio rerio*) embryos were chronically exposed to two synthetic general cannabinoid receptor agonists, Anandamide and WIN55,212-2. The embryos were observed at 24, 48, and 72 hours post-fertilization, and an in situ hybridization was performed to determine the expression of the two known endocannabinoid receptors, Cnr1 and Cnr2. Embryos treated with the compounds showed a variety of defects, including premature hatching, decreased length, curved tails, and pericardial edema. These findings suggest that exposure to cannabinoids at the beginning of pregnancy can alter anatomical development.

08:55-09:00

3-06 Increasing stress tolerance in *Saccharomyces cerevisiae* using lipocalin protein families. ***Ximena Leon*, William Khomtchenko, Catarina Felgueira, Thomas Galbato, and Jose Barbosa***, *The University of Tennessee at Chattanooga, Chattanooga, TN*. *Saccharomyces cerevisiae* is a microorganism commonly used in industrial processes, but its productivity is significantly hindered by its inability to resist high stress levels. We identified knockout yeast strains that are sensitive to various stressors. The yeast knockouts ALD3, ALD4, PDX3, and ILV1 showed sensitivity to both heat and oxidative stresses. Additionally, ILV1 and PDX3 were also sensitive to osmotic stress. We then distinguished lipocalins from *Arabidopsis thaliana* and *Homo sapiens*. It was discovered that lipocalins play a role in stress response, so they could potentially increase stress tolerance in yeast through heterologous complementation. To test this, we cloned each of the lipocalins, TIL, OBP2A, OBP2B, FABP4, and RBP4, into the yeast shuttle vector, p415 GPD, and transformed them into the knockouts. The cells were tested against the stressors, and the phenotypes will be compared to the wildtype and knockout cells to determine if they show lipocalin-mediated increased stress tolerance.

Chemistry Posters

08:30-08:35

4-01 Gas chromatography- mass spectrometry analysis of CBD oil samples. ***Kaylan R. Beaty, Parker Miranda, Leslie A. Hiatt, and Anuradha Liyana Pathiranage***, *Austin Peay State University, Clarksville, Tennessee*. Cannabidiol (CBD) oil is derived from the cannabis plant and contains possible health benefits along with potential risks. As the public increases its desire for more holistic remedies and medicines, the use of CBD oil has grown exponentially. Despite being used for both recreational and medicinal uses for thousands of years, there is a huge void of reliable information regarding chemical content in CBD oil samples. There are hundreds of CBD oil products that be found in common drugstores with different formulas that lack reliable data. One of the most important methods to analyze compounds present in CBD oil is combined Gas Chromatography-Mass Spectrometry (GC-MS). During this project, different commercial CBD oil samples were analyzed using GC-MS. Analyzed CBD oils samples showed numerous chemicals other than CBD, including chemicals from oil tinctures and hemp extracts.

08:35-08:40

4-02 Liquid-liquid extraction and ultraviolet visible spectroscopy methods for distinguishing between hemp and marijuana. ***Brooke A. Underwood*, Courtney E. LaPointe, and Jeffrey O. Boles***, *Tennessee Technological University, Cookeville, Tennessee*. Passage of the Farm Bill in December 2018 legalized cannabis containing less than 0.3% tetrahydrocannabinol (THC), otherwise known as hemp (1). This creates problems for law enforcement since current presumptive test kits either 1) don't work at all or 2) work somewhat in differentiating between legal and illegal hemp crops. This problem exists because most hemp crops and hemp products contain low levels of THC and the carboxylated form, THCA. Our approach involves the advancement of an efficient, mobile, liquid-liquid extraction (LLE) that provides presumptive, qualitative forensic evidence of the chemical extract of a bud or other plant material. This research is focused on developing a kit that functions in a similar manner to NIK kits, commonly used by law enforcement, where all components of the kit are contained within a bag. The current NIK kit for Marijuana provides a false positive when Hemp is placed in the bag, thus creating the need for a more reliable test (2). The evidence would later be sent to a crime lab for definitive analysis and quantitation of THC by ultraviolet-visible spectroscopy (UV-vis). This research has focused on the utilization of liquid-liquid extraction techniques and commercially available stains. The methods presented are rapid (requiring no more than five to six minutes to complete). The differentiation between two lots of commercially available hemp and seven lots of marijuana obtained from the Cookeville City Police will be presented.

08:40-08:45

4-03 Quantification of boswellic acids in frankinsense essential oils. ***Alex O'Donnell*, Hannah Richards*, and Meagan K Mann***, *Austin Peay State University, Clarksville, Tennessee*. Essential oils have become increasingly advertised as a viable alternative to traditional pharmaceuticals. The FDA does not evaluate medical claims on such products, so they make it to market promoting unverified medical claims and with little to no supporting research. While phytochemicals of medicinal value are well-known, the process by which essential oils are collected may destroy, denature, or fail to extract the medically relevant molecule(s) in the plant material. Boswellic acids, a group of structurally similar pentacyclic terpenoids found in the gum resin of boswellia serrata (frankincense), are one such example. These molecules have shown promise as anti-cancer therapeutics in both in vitro and in vivo studies but would be unlikely molecules to find in an essential oil due to their size. Regardless, anti-cancer claims are often cited by essential oil companies as a potential use for their frankincense oil. Here, progress towards GC-MS quantification of total boswellic acid content in boswellia serrata gum resin, the steam distillate from that resin, and in commercially available frankincense essential oil samples is presented.

Ecology & Environmental Science Posters

08:30-08:35

5-01 Population genetics of the widespread crucifer *Boechera laevigata* (Brassicaceae). ***Annie Lindsey* and Carol Baskauf***, *Austin Peay State University, Clarksville, Tennessee*. *Boechera laevigata* is the most widespread *Boechera* species in eastern North America. Its expansive geographic range contrasts with its rare and genetically depauperate relative *B. perstellata*. To gauge the genetic diversity of this widespread species and contextualize the low diversity in *B. perstellata*, a population genetics study of *B. laevigata* utilizing 14 populations from 11 states was completed. Seventeen polymorphic loci were resolved, with population level polymorphism averaging 50.4%. Alleles per polymorphic locus averaged 10.1 and ranged from 2 to 30 alleles. Three populations displayed fixed heterozygosity at most loci, indicating possible polyploidy. Heterozygote deficits were evident at most loci for the other populations, suggesting substantial inbreeding (FIS= 0.704, P< 0.001). AMOVA estimated differences among all populations to account for 60% (FST= 0.599, P< 0.001) of genetic variation in the species. These results will be useful to compare and contextualize the genetic diversity in *B. laevigata* and *B. perstellata*.

08:35-08:40

5-02 Corticolous lichen species richness and abundance in relation to proximity of traffic in Nashville, Tennessee. ***Taylor Ruscitti*, Bethany Wood*, Gerald Archer*, Chris Barton, and Darlene Panvini***, *Belmont University, Nashville, Tennessee*. Lichens, a symbiotic relationship between fungi and algae, are often used as bioindicators of air quality. Lichens absorb water and nutrients from the air causing them to be affected by air pollution levels. We predicted an increase in lichen richness and abundance in urban areas as distance from high-traffic areas increases. Corticolous lichen samples were collected from three locations in Nashville, Tennessee with varying proximity to high-traffic streets. Given the challenges of field identifying lichens, DNA isolation and amplification was used to sequence and identify lichen species using BLAST. Of our three locations, we saw differences in coverage, abundance, and richness of lichen. Other factors such as use of chemicals, elevation, and tree species may also affect lichen diversity. This study provides a baseline data set for future analysis of air quality and land use within Nashville, Tennessee.

08:40-08:45

5-03 Occurrence of birds in relation to tree canopy cover in an urban environment. ***Joaquin Pasco*, William Messick*, and Darlene Panvini***, *Belmont University, Nashville, Tennessee*. Urban environments are constantly developing, with buildings rising and vegetation being removed or altered to make urban spaces functional and/or aesthetically pleasing. As a result, shifts in species richness and diversity can occur with urbanization, particularly for avian species that are reliant on available tree canopy covering. This study examined the occurrence of birds in relation to tree canopy cover at three sites in Nashville, Tennessee. Each site had subplots consisting of low, medium, and high canopy cover chosen by looking at GIS vegetation maps. Bird occurrence was determined for one hour before and after both sunrise and sunset on nine dates at each site using visual observations and the Smart Bird ID app to record bird vocalizations. Preliminary analysis suggests that the assemblage of bird species is correlated to canopy cover. This baseline dataset could provide input to city foresters regarding ideal tree densities to support urban avian communities.

08:45-08:50

5-04 Habitat value of naturalized water hyacinth for fishes and macroinvertebrates. ***Champagne J. Cunningham*, Frank Jordan, and Tom Byl***, *Loyola University New Orleans(CC, FJ), Tennessee State University(TB,CC)*. Water hyacinth (*Eichhornia crassipes*) is a floating aquatic plant native to the Amazon Rivers. Water hyacinth was introduced into Louisiana in the late 1800s. Water hyacinth is considered an

invasive species and assumed to negatively affect native ecosystems. Hyacinth is now considered naturalized. The objective of this study was to determine if hyacinth provide ecosystem benefits. Mesocosms were established with and without hyacinth, herbicide, and small fish to determine what effects it would have on macroinvertebrate recruitment, water temperature and dissolved oxygen (DO). Two months of monitoring found hyacinth had no significant effect on water temperature. Mesocosms with hyacinth had a 33% lower DO from those without hyacinth. When herbicide was added, there was a 98% decrease in DO, due to plant decomposition. The mesocosms containing hyacinth and herbicide also had the highest macroinvertebrate recruitment. Water hyacinths appear to influence macroinvertebrate recruitment and DO in mesocosm systems. Unfortunately, sample processing was not completed due to the COVID-19 pandemic.

08:50-08:55

5-05 The spatial sensitivity of the proboscis in *Manduca sexta*. ***Emily Hudgins*, Benjamin Allen, Jacob Zielke, Buskin Barnes, and Joaquin Goyret***, *The University of Tennessee at Martin, Martin, Tennessee. Manduca sexta* is a large, crepuscular-nocturnal hawkmoth that forages for floral nectar. To locate flowers it uses mostly olfactory and visual stimuli, but when hovering in front of the flower with its long proboscis extended it utilizes tactile stimuli to find the concealed nectar. Initially, it taps on the floral surface maintaining a steady distance from the flower, but upon detection of surface features such as grooves, it displays a behavior in which it conspicuously start flying back-and-forth, while maintaining proboscis-flower contact. Using 3D-printed surrogate flowers with different groove sizes (1 mm, 0.1 mm, 0.05 mm, and 0mm i.e. smooth surface) we exploited this behavior to determine the spatial sensitivity of the tactile sense of the proboscis. Results show moths can detect up to 0.1 mm grooves. In our poster we discuss these results, future directions, and an ongoing control for the possible influence of visual detection of grooves.

08:55-09:00

5-06 The importance and process of fungarium digitization at the University of Tennessee at Chattanooga. ***Miranda Phillips*, Dakila Ledesma*, Joey Shaw, and J. Hill Craddock***, *The University of Tennessee at Chattanooga, Chattanooga, Tennessee*. Virtual herbarium databases, such as the MyCoPortal, allow collections to be accessed and studied by an online audience. The fungal herbarium -- the Fungarium -- at the University of Tennessee at Chattanooga contains roughly 3800 specimens. Our goal is to digitize the Fungarium collection and upload the images and transcribed labels to the MyCoPortal. The process includes transcription of label data, creating bar-coded labels, photographing the specimens using a lightbox, and then uploading the images and transcribed data. By uploading images and label data, UTC will set itself apart from other collections on the MyCoPortal, since many contain transcribed label information and no specimen images, or vice versa. Connecting UTC's Fungarium to the MyCoPortal database will contribute to the database's mission to build a collaborative biodiversity resource network and enable the UTC collection to be used to further our understanding of the myriad fungal species that occur in our region.

09:00-09:05

5-07 Molecular identification of three freshwater crayfish species at Streams in Giles County, Tennessee. ***Samantha Kilian* and Stanton Belford***, *Martin Methodist College, Pulaski, Tennessee*. Crayfish in North America undergo continued threats, such as habitat fragmentation, degrading water quality, and addition of invasive species to their local habitats. Research to track crayfish populations and maintain accurate taxonomy is necessary. This study used molecular and phylogenetic analyses to identify crayfish species, and determined size and morphology at three localities along Pleasant Run Creek in southern Tennessee. Hand-held seines were used to collect crayfish over a two-year period. We

recorded morphological data, such as carapace length (CL), total length (TL), weight, and molecular data using the COI gene. Results showed that crayfish TL differed significantly among sites (ANOVA, $F(2, 81) = 5.671$; $p < 0.05$). Weight and CL did not differ significantly among sites ($p > 0.05$). Molecular analysis recorded 3 local species: *Faxonius durelli*, *Orconectes wrighti*, and Cambarus sp. Annual surveys will continue to determine the status of population densities and accurate species identification.

Geology & Geography Posters

08:30-08:35

6-01 The highest point on the surface of the Earth. ***Kyle Rose and Arjun Tan***, *Alabama A & M University*. There is an interesting question regarding the highest point on the surface of the Earth. Whereas Mt. Everest is the highest point from the sea level, Mt. Chimborazo is the farthest point from the center of the Earth. In the first scheme, Mt. Everest is 2.58 km higher than Mt. Chimborazo, whereas in the latter scheme, Mt. Chimborazo is 2.10 km farther away from the center of the Earth than Mt. Everest. In this study, we formulate a third scheme to break the deadlock. In this scheme, the 'attracting center' of the two locations is defined as the intersection point between the plumb lines at the two locations when placed on the same meridional plane. Mt. Everest is found to be 2.29 km farther away from this attracting center than Mt. Chimborazo, thus reclaiming its title as the highest point on the surface of the Earth.

08:35-08:40

6-02 Ocean depth closest to the center of the Earth. ***Kyle Rose and Arjun Tan***, *Alabama A & M University*. The deepest part of the world ocean is called the Challenger Deep located on the Marianas Trench in the Pacific Ocean. It is at least 10.984 km deep from the sea level. However, due to the oblate spheroidal shape of the Earth, it is not the closest point of the lithosphere to the center of the Earth. In this study, we show that the deepest part of the Arctic Ocean, called the Molloy Hole, at the depth of 5.550 km from the sea level, is actually 14.369 km closer to the center of the Earth than the Challenger Deep. That makes the Molloy Hole location the closest point of the solid lithosphere to the center of the Earth.

Health & Medical Sciences Posters

08:30-08:35

7-01 Comparison of polyclonal antibodies for detection of *Campylobacter* flagellin protein using surface plasmon resonance (SPR). ***Shreya Singh Hamal*,*** **and** ***Fur-Chi Chen****. Tennessee State University, Nashville, Tennessee*. Campylobacteriosis is an important worldwide foodborne disease caused by *Campylobacter*. Optical based Surface Plasmon Resonance (SPR) biosensors are sensitive methods for detection of *Campylobacter* in foods. The objective of this research was to develop a rapid screening method by comparing the binding characteristics for the selection of three commercial polyclonal antibodies using SPR. This work used a SPR biosensor for the selection of three commercial polyclonal antibodies (Invitrogen, Biorad and Prosci) against the flagellin protein of three different strains of *C. jejuni*. Individual polyclonal antibody was immobilized on the sensor surface and their evaluation was based on the binding characteristics against the flagellin protein of *C. jejuni*. The SPR biosensor showed highest binding signal for Biorad polyclonal antibody against flagellin protein of three different strains of *C. jejuni* in comparing to Invitrogen and Prosci polyclonal antibodies. These differences were statistically significant ($p<0.05$). The application of SPR in this study provided a rapid and accurate selection of fine performing antibodies for *Campylobacter* detection.

08:35-08:40

7-02 Accessory belly of rectus femoris muscle – a case report and review of the literature. ***Kale B. Davidson* and Jonathan A. Millard****, *Lincoln Memorial University – DeBusk College of Osteopathic Medicine, Harrogate, Tennessee*. Purpose: Understanding variations of the rectus femoris muscle may be useful for many surgical procedures and should be considered by clinicians. Methods: During a routine cadaveric dissection of the right thigh of a 103 y/o male an additional (third) rectus femoris muscle belly was found fusing distally with the vastus lateralis muscle, prompting a review of the literature. Results: Reports describe both an accessory muscle slip inserting into the anterior surface of the vastus lateralis muscle and fusion of the vastus lateralis with the lateral border of the rectus femoris. An additional study identified a third rectus femoris head in 83% of 48 cadavers (96 sides); however, the most common attachment was with the gluteus minimus muscle. Conclusion: Variability in rectus femoris muscle morphology is poorly understood. Reports of variation of the rectus femoris muscle are exceedingly rare when compared to other muscle groups, warranting further investigation for clinical applications.

08:40-08:45

7-03 Novel bacteriocin and bactericidal compounds for augmenting pressure-based elimination of planktonic cells of *Staphylococcus aureus*. ***Jyothi George* and Aliyar C. Fouladkhah***, *Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37209, USA*. As a commensal bacterium *Staphylococcus aureus* can potentially be isolated from the mucosa or skin of humans. Recent epidemiological studies indicate that S. aureus could be isolated from >20% of healthy individuals. The bacterium is capable of causing infections and foodborne intoxication in susceptible individuals. Our study investigated utilization of three novel bacteriocin and bactericidal compounds (carvacrol, nisin, and caprylic acid) for pressure-based inactivation of this pathogen of public health concern. We observed that >90-99% of the pathogen population could be inactivated using synergism of elevated hydrostatic pressure and antimicrobials. These findings could assist stakeholders of elevated hydrostatic pressure to assure safety of their commodities against this prevalent pathogen of public health concern.

08:45-08:50

7-04 Dose-response meta-analysis of prospective studies demonstrated a paradox within the obesity paradox in stroke and renal cancer carcinoma. ***Minoo Bagheri***, *Public Health Microbiology Laboratory, Tennessee State University, Nashville, TN 37209, USA*. In healthy individuals, mortality increases as BMI surpasses 25 kg/m2. In some diseases, however, obesity was associated with greater survival; the finding known as 'obesity paradox'. We performed dose-response meta-analyses to address the association of each unit increase in BMI with disease-specific and overall mortality/survival in patients suffering from stroke and renal cancer carcinoma (RCC). Relevant records were identified by a systematic search of Pubmed, OVID and Scopus databases. Random-effects dose-response models were carried out to analyze the data from various recent studies. Significant non-linear dose-response relationships were found between BMI and disease-specific or overall mortality/survival. In stroke, an increased risk of OM but a decreased risk of SSM was suggested as BMI increased. Likewise, in RCC sufferers, CSS increased while OS decreased in relation to BMI. In these meta-analyses performed in two different diseases paradoxical findings were observed on the association of BMI with disease-specific and overall mortality/survival.

History of Science Posters

No poster presentations

Mathematics & Computer Science Posters

No poster presentations

Microbiology Posters

08:30-08:35

8-01 Degradation of aflatoxin B1 in almond milk using UV-C irradiation: A kinetic study. ***Anjali Kurup*, Brahmaiah Pendyala and Ankit Patras***, *Tennessee State University, Nashville, Tennessee*. The efficiency of UV-C (254 nm) light on degrading the naturally present carcinogen, aflatoxin B1 (AFB1), in almond milk (AM) was investigated (0 to 120 mJ.cm-2 dose range). Based on the absorption coefficient (1407 m-1) and scattering coefficient (3668 m-1) of AM, the delivered average fluence was calculated to be 0.015622 mW/cm2 using computational fluid dynamics and inverse addling and doubling techniques. AM was spiked with known concentration of AFB1 prior to irradiation. AFB1 was quantified with reverse phase high performance liquid chromatography (HPLC) combined with fluorescence detector. Degradation kinetic rate constant of AFB1 in almond milk was calculated as 0.0083 cm2/mJ. UV-C fluence at 120 mJ.cm-2 reduced AFB1 to 72.4±0.03 %, $p<0.05$. The quantum yield of AFB1 was found to be 3.35×10-4, absorbed energy was found to be 7.82×10-19 J. This study clearly demonstrated the efficacy of UV-C in reducing AFB1 in AM below FDA recommended limit.

08:35-08:40

8-02 Evaluation of physiological traits expressed *in vitro* and effects on plant growth by *Bacillus* endophytes. ***Jewel Galloway****, *Middle Tennessee State University, Murfreesboro, Tennessee*. *Bacillus* species are an important group of rhizobacteria that have been shown to enhance the growth of plants and protect against plant pathogens. This study investigated the mechanisms used by *B. atrophaeus* and *B. thuringiensis* to promote plant growth. Effects of each bacterial strain on the growth of *Brassica rapa* were evaluated under greenhouse conditions with sterile soil. Plant growth promotion traits including nitrogen fixation, phosphate solubilization, and siderophore production were assessed as well as antagonistic activities against two soil-borne pathogens, *Fusarium oxysporum* and *Agrobacterium tumefaciens*. To verify nitrogen fixation activity, the nitrogenase gene, *nifH*, was amplified by PCR. Plants inoculated with *B. atrophaeus* had significantly greater biomass and increased length compared to the control. *Bacillus atrophaeus* exhibited antimicrobial and nitrogen fixation activity while *B. thuringiensis* was positive for siderophore production. These bacteria could potentially be used to enhance plant growth while reducing environmental costs associated with synthetic chemicals.

Physics & Astronomy Posters

08:30-08:35

9-01 Compositional dependence of temperature-induced shift of the fundamental optical absorption edge in As-S glasses. ***James Forsythe* and Roman Golovchak***, *Austin Peay State University, Clarksville, Tennessee*. The arsenic sulfide glasses are widely used in photonics and fiber-optics due to their exceptional transparency to infrared radiation. At the same time, their fundamental optical absorption edge is known to be highly sensitive to temperature changes. So far, this effect is comprehensively studied only for stoichiometric As2S3 glass. Present results reveal a strong dependence of the temperature sensitivity of absorption edge on the composition of glass. The samples from AsxS100-x

glass-forming region (10<x<42) are investigated with optical spectroscopy from liquid nitrogen up to their glass transition temperatures.

08:35-08:40
9-02 Photo-response of mixed germanium-antimony based chalcogenide thin films at different temperatures. ***Jarres Plummer* and Roman Golovchak***, *Austin Peay State University, Clarksville, Tennessee*. Electrical properties of amorphous chalcogenide thin (~1 micron) films that contain germanium and antimony are studied at different temperatures under simultaneous exposure to light of different wavelengths and intensities. The change in the dark resistance with temperature is found to follow a typical exponential decay for semiconducting materials within a -100 °C – 150 °C range. Light exposure of the samples causes a 5-15% drop in their DC resistance when compared to dark, showing a strong dependence on the photon's energy and intensity. An increase in the temperature leads to a decrease in photo-response of the investigated material, which vanishes at temperatures close to the glass transition temperature. The obtained results have considerable potential for applications in optoelectronics and sensors.

Science and Math Teaching Posters

08:30-08:35
10-01 Anticipating the needs of introductory nutrition students and faculty learning through an etextbook platform: A literature review. ***Terra L. Smith and Loveday E. Nwobilor***, *The University of Memphis, Memphis, Tennessee, and Shelby Residential and Vocational Services, Memphis, Tennessee*. As textbook publishers search for sustainable business models, introductory nutrition students and faculty are caught in tides of change that have created etextbook platforms. The purpose of this project is to determine the needs, challenges, and perceived benefits of introduction to nutrition students and faculty when learning through an etextbook platform. The objective of this project at this stage is to review literature that will help anticipate the questions to which the target population would appreciate answers. A literature search has yielded the following possible points of concern about etextbook platforms: course materials affordability, access, privacy, out sourcing, course content, platform features, ease of use, online learning, intellectual and academic freedom, technical issues, learning analytics, instructor workload, engagement, policies, and integration into personal technology. Once identified and verified the needs of introductory nutrition students and faculty in relationship to an etextbook platform can be effectively addressed.

08:35-08:40
10-02 Transforming the image of STEM careers for female middle and high school students across Tennessee. ***Nicole Gammons, Shruthi Perna, and Judith Iriarte-Gross***, *Middle Tennessee State University, Motlow Community College, NIMBioS at University of Tennessee Knoxville, Volunteer State Community College and Walters State Community College*. The mission of the MTSU Women in STEM (WISTEM) Center is to enable the campus and community to realize the intellectual potential and utilize the expertise of women in the STEM disciplines. Middle and high school young women will be introduced to STEM careers from women role models, virtual experiments that can then be taken back to their school or home to share with friends and family, and professional development opportunities such as mentoring and networking. The Center recognizes the growing demand for STEM degrees and occupations in Tennessee. Since the 2009, with the establishment of the MTSU WISTEM Center, the EYH conference has expanded to five sites across the state of Tennessee. The first EYH was established at MTSU in 1997 and since then, over 9000 young women have been introduced to resources and opportunities to pursue STEM education and careers.

Zoology Posters

08:30-08:35

11-01 The salience of visual and olfactory stimuli in crepuscular-nocturnal hawkmoths under varying illuminations. ***Buskin Barnes*, Benjamin Allen*, Emily Hudgins*, and Joaquín Goyret***, *Department of Biological Sciences, University of Tennessee at Martin, Martin, Tennessee*. *Manduca sexta* are nectarivorous, crepuscular-nocturnal hawkmoths of the Americas. They find and choose flowers using mainly visual and olfactory information, and innate biases for particular colors (blue) and odors ("sweet"). Beyond their innate biases, they can learn to follow fluctuating nectar offerings through associative learning. Previous work has shown diurnal moths associate the color of flowers with rewards, while nocturnal moths associate rewards with their scent. Does a moth with a crepuscular-nocturnal lifestyle behave like a nocturnal or a diurnal moth? In a classic associative learning paradigm, we are using combinations of these sensory cues under different illuminances, to investigate if the salience of visual and olfactory stimuli changes depending on the foraging conditions (nocturnal/crepuscular). Here, we present results under crepuscular illuminances and discuss their implications.

08:35-08:40

11-02 Eastern Red Bat and Evening Bat foraging strategies. ***Darian Bricker* and Nancy Buschhaus***, *University of Tennessee at Martin, Martin, Tennessee*. Most species of bats in the eastern United States have calls of different frequencies and different patterns. Bat calls with similar frequencies can cause interference in echolocation patterns affecting the ability of individuals to hunt insect prey. Therefore, two individuals of different bat species with call frequencies that are similar may avoid using the same airspace at the same time. Our study examined whether two common species in West Tennessee, the Eastern Red Bat, *Lasiurus borealis*, and the Evening Bat, *Nycticeius humeralis*, with similar call frequencies tended to forage in the same airspace at the same time in the fall. We collected data at five locations in West Tennessee using Wildlife Acoustics SM4BAT detectors. Bat passes were initially analyzed using SonoBat v.4.2.2 North America with the West KY/TN classifier followed by manual vetting. Activity varied by time, species, and location at the five study sites.

08:40-08:45

11-03 A comparison of bat activity and species richness at suburban vs. rural ponds in West Tennessee. ***Katelynn Hacker* and Nancy Buschhaus***, *University of Tennessee at Martin, Martin, Tennessee*. An important aspect of species conservation is understanding habitat use of organisms in various habitat types. A greater proportion of natural habitats are being converted to suburban and urban environments, potentially affecting the species that use those regions due loss of critical microhabitat features within those environments. Several bat species in Tennessee use ponds to forage and wooded areas to roost. Our study examined whether there was a difference in bat activity and species richness between suburban ponds and rural ponds located in West Tennessee. Wildlife Acoustics SM4BAT detectors were used to collect data at 5 ponds in West Tennessee: 2 located in suburban areas and 3 located in rural areas. Bat activity and species richness were determined using an initial analysis by SonoBat v. 4.2.2 North America with a West KY/TN classifier followed by manual vetting of bat passes. Bat activity and species richness varied among these ponds.

08:45-08:50

11-04 The correlation of roost habitat availability and bat activity at West Tennessee ponds. ***Gabriel Martin* and Nancy Buschhaus***, *University of Tennessee at Martin, Martin, Tennessee*. One of the causes for decline in bat populations is the loss of habitat. Different species of bats often use different species and ages of trees as roosts during the day. Therefore, if those tree species and/or ages of trees are not available in an area, some bat species may be excluded from an area. This study examined the

correlation of roost availability with bat activity and species richness at five ponds that varied in the amount of forested area surrounding the pond. We collected data with Wildlife Acoustics SM4BAT detectors. Bat passes were analyzed to species when possible first using SonoBat v.4.2.2 North America with a West KY/TN classifier, then the bat passes were manually vetted. Bat activity and species richness varied between ponds. The results of this study may be important to the conservation of bat populations.

08:50-08:55

11-05 The effect of time of night and habitat on bat activity in West Tennessee. ***Mackinzie Tolliver* and Nancy Buschhaus***, *University of Tennessee at Martin, Martin, Tennessee*. Bat activity varies with time of night in some populations of bats. In general, for many bat species there is a large peak of bat activity shortly after nightfall and another smaller peak of activity close to dawn. However, given that suburban environments have significant light pollution compared to rural environments, these common peaks in bat activity might be disrupted. Our study examined whether the pattern of bat activity was different at suburban versus rural ponds in West Tennessee. The bats in this study were sampled from two suburban ponds and three rural ponds in West Tennessee. Data was collected using Wildlife Acoustics passive SM4BAT detectors. SonoBat v 4.2.2 North America with a West KY/TN classifier was used for initial classification of bat passes, followed by manual vetting of the bat passes for confirmation. Bat activity varied throughout the night at both suburban and rural ponds in the study.

08:55-09:00

11-06 The efficacy of using bat activity as an ecological indicator to monitor wetland restoration. ***Kayla Long*, Clay Bliznick*, Karen Baumann, Andrea Darracq, Howard Whiteman, and Nancy Buschhaus***, *University of Tennessee at Martin, Martin, Tennessee (KL, NB), and Murray State University, Murray, Kentucky (CB, KB, AD, HW)*. A large proportion of Tennessee's wetlands have been lost due to human activities such as agriculture, channelization and sedimentation. The loss of wetlands has led to economic and environmental consequences including deterioration of erosion control, increased flood damage, increased water pollution, and decreased species diversity. The restoration of Tennessee's wetlands is critical to the wellbeing of the environment. Many restoration projects have been initiated around the state, with most monitoring involving changes in plant, invertebrate, avian or amphibian species diversity. However, monitoring changes in bat activity and species diversity could effectively serve as a mammalian indicator of restored wetland function due their use of wetlands and the ease of acoustic monitoring of bat activity. As an initial step in a larger project, we compared both bat species presence and activity at three well-established rural ponds in West Tennessee to that of wetlands in agricultural areas at various levels of disturbance.

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