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Oral Presentations

Agriculture

Section Chairs: Will Bird, Emalee Buttery, Rachna Tewari

Using data from nursing programs and the NCLEX as a model to predict success on the Veterinary Technician National Exam *(VTNE)* ***Meera Patel*, Jason Roberts, Joseph Mehlhorn and Scott Parrott,*** *The University of Tennessee at Martin, Martin, Tennessee.* The University of Tennessee at Martin's Veterinary Technology program is new and faced with challenges of ensuring student pass rates on the Veterinary Technician National Examination (VTNE). Literature review finds minimal information on factors affecting VTNE pass rates. There is a large body of information on factors affecting the pass rate of the human nursing licensure exam (NCLEX). Data was collected to evaluate the correlation of predictive factors between the NCLEX and VTNE. Results indicate that GPA and ACT scores are the strongest indicators of pass rates on both the NCLEX and VTNE. Results indicate that predictive indicators from the NCLEX can be used as an accurate model for the VTNE.

Analysis of necropsy data on cattle in West Tennessee with a focus on preventable disease. ***Kaitlyn Courtney*, Clint Ary, and Emalee Buttrey,*** *The University of Tennessee at Martin, Martin, Tennessee.* The West Tennessee Animal Disease Diagnostic Laboratory on the University of Tennessee at Martin campus performs necropsies on animals from producers in West Tennessee. Tissue samples are then sent to C.E. Kord Animal Disease Diagnostic Laboratory in Nashville for testing. This process gives producers valuable information as to the cause of unexpected animal deaths. The objective of this project is to analyze data from our lab to determine correlating factors (e.g., season, age, breed, or sex) that could contribute to the susceptibility of cattle to preventable disease. The results show the seasonal distribution of deaths from preventable diseases such as blackleg, bovine respiratory disease, and anaplasmosis and what age groups are most susceptible. This can help producers maintain healthier herds.

Assessing cattle producer perceptions of calving management strategies. ***Kimberly Inman*, Clint Ary, Will Bird, Jason Roberts, and Joey Mehlhorn,*** *The University of Tennessee at Martin, Martin, Tennessee.* Cattle producers in West Tennessee were surveyed to determine the common cattle management practices associated with identifying dystocia in their herds. Key issues are techniques producers use to identify potential problems and the methods for observing cattle before calving. The focus is to determine a baseline of current practices among West Tennessee producers and understand what training programs or technologies could be beneficial for producers. Results indicated that producers who participated in advanced training programs and utilized continuous monitoring had the lowest calving mortality rates. Producer education on the management of cattle reproduction, using strategies for early detection of dystocia, and importance of genetics in decreasing the frequency of dystocia should be a top priority for successful beef cattle operations in Tennessee.

Effects of nitrogen and cultivar type on germination and soil coverage in winter canola (*Brassica napus* L.) in Tennessee. ***Kyle D. McGeary*, Jason P. de Koff, Priya Saini, and Richard Link,*** *Tennessee State University, Nashville, Tennessee.* Winter canola production has been increasing in recent decades, due to its many uses. Concerning a lack of research on characteristics of winter canola in the southeastern U.S. the objectives of this study sought to determine the effects of five different nitrogen (N) rates on germination and soil coverage across three different cultivars (2017–2018). Current data showed a positive relationship between N and plant counts with the Edimax CL variety. Plant counts were not directly correlated with soil coverage indicating that leaf area played a large role. Time and cultivar were more important for soil coverage than N rates. Nitrogen was important for early germination, however, was less significant in later stages of growth.

Prevalence of antimicrobial resistance *Enterobacteriaceae* in plant-based milk. ***Winnie Mukuna* and Agnes Kilonzo-Nthenge,*** *Tennessee State University, Nashville, Tennessee.* Owing to the current life styles and increase of cow milk allergy, plant-based milk is becoming popular in many consumers' homes. However, studies evaluating microbial safety of plant-based milk are uncommon. This study evaluated the prevalence and antimicrobial resistance of *Enterobacteriaceae* in soy, almond, and cashew milk by using

biochemical and molecular techniques. *Enterobacteriaceae* was tested for susceptibility to 8 antimicrobials by disk diffusion method. The most prevalent species was *Enterobacter cloacae* (42.3%), and *Enterobacter cancerogenus* (35.1%). Antimicrobial resistance was significantly ($P < 0.05$) higher in vancomycin (85.9%) and novobiocin (80.5%), than cefpodoxime (35.5%) and nalidixic acid (5.3%). Eleven multi-antimicrobial resistance patterns were identified. No resistance to imipenem was observed. These data suggest that plant-based milk harbors antimicrobial-resistant *Enterobacteriaceae,* hence may play a role in dissemination of potentially pathogenic antibiotic resistant bacteria.

A qualitative assessment of consumer preferences when buying fruits and vegetables. ***Enefiok Ekanem and Mary Mafuyai,*** *Tennessee State University, Nashville, Tennessee.* The purpose of this paper is to discuss the characteristics that Tennessee consumers value when purchasing fruits and vegetables. The objectives are to assess how consumers perceive the physical attributes of color, freshness, variety and price in their fruits and vegetable purchasing decisions. This paper also evaluates consumer assessment of the importance of nutritional value, safety, locally grown and knowing the grower. Data collected from a face-to-face survey of farmers' market shoppers in Nashville metropolitan and surrounding areas were analyzed for this paper. Results showed that price followed by safety were the two most important attributes influencing consumer decision to purchase fruits and vegetables. Although previous consumer studies showed that other factors influenced consumer decisions, current study focus only on the physical characteristics of fruits and vegetables.

Solar swarm: effect of the August 2017 solar eclipse on *Apis Mellifera.* ***Emily Rendleman*, Robert Moore, and Donald Sudbrink,*** *Austin Peay State University, Clarksville, Tennessee.* Honey bees and other members of Apidea have been studied for many years, and one subject of great interest is their behavior during solar eclipses. Much of the data previously collected have been anecdotal reports of honey bee behavior with few quantifiable observations. This experiment conducted during the August 2017 total solar eclipse attempted to integrate quantitative and qualitative data. Three hives of *Apis mellifera* were observed between the hours of 11 AM and 4 PM, with photographic and video records being made of bee numbers present on hive landing boards at select time intervals. Results showed dramatic differences in behavior between that of a normal day and the period of totality, with a dramatic influx of bees as skies darkened.

Botany

Section Chair: Claude Bailey, Jr.

Historical and currently-known distribution of *Trifolium reflexum* L. (Buffalo Clover, Fabaceae) in Tennessee. ***Edward W. Chester,*** *Austin Peay State University, Clarksville, Tennessee. Trifolium reflexum* is a native clover mostly distributed west of the Mississippi River. It is rare eastward and of conservation concern in several states, including Tennessee. Field and herbarium studies show that the species occurs (or once occurred) across Tennessee, but most county reports have not been verified for more than 30 years. Specimens have been examined from the following counties, with the number of sites reported for the county, year of the last report, and the herbarium source (using standard abbreviations) given parenthetically. Shelby (one, 1920, MOBOT); Madison (one, 1920, TENN); Davidson (one, possibly two, 1878 at TENN and1898 at CM); Montgomery (one, 1974, APSC and TENN); Lewis (one, 1945, VDB at BRIT); Blount (one, 1998, TENN and LSU, presence confirmed in 2017); Polk (one, 2015, UTCH). These reports verify rareness in the state and the current listing of endangered is warranted.

Waves or Ripples? Whole genome duplication and plant community structure. ***Michelle Gaynor*, Julienne Ng, and Robert G. Laport,*** *University of Florida, Gainesville, Florida (MG), University of Colorado-Boulder, Boulder, Colorado (JN), Rhodes College, Memphis, Tennessee (RGL).* Polyploidy has played an important role in the evolution and diversification of vascular plants. However, the influence of genome duplication on population- and community-level dynamics remain unclear. We investigated how community-level patterns of phylogenetic relatedness among Brassicaceae and Rosaceae species might influence species interactions by testing (1) whether polyploid species are more distantly related to diploids within the same community than co-occurring diploids are to one another, and (2) if polyploid species tend to exhibit greater ecological success (are more abundant) than diploids. We find that polyploid species tend to be more distantly related to co-occurring diploids than diploids are to each other. However, we do not find a consistent pattern of polyploid species being more abundant than diploid species, suggesting polyploids are not uniformly more ecologically successful than diploids. Our study also highlights the paucity of available geographically explicit data on intraspecific ploidal variation.

Isolation of Sweet Sorghum microspores to identify the microsporogenesis stages towards creating double haploid plants. ***Aron Felts* and Ahmad Aziz,*** *Tennessee State University, Nashville, Tennessee.* Double haploid tissue culture is a powerful biotechnology tool for genetic manipulations in over 200 different plant species. However, such procedures for an important crop, *Sorghum bicolor,* are virtually non-existent to date. For inducing androgenesis, specific stressors need to be applied at the unicellular/binucleate stages during microsporogenesis. After tetrad cytokinesis, unicellular microspores (natural protoplast) are released without having fully formed exine. Four varieties of sweet sorghum were monitored to capture panicles containing free microspores at desired developmental stage. The

absence of exine formation was verified through lysis with Repli-G Single Cell Kit as well as confirmation of DNA yields via NanoDrop. Microspores can be captured and confirmed under high-power microscope during unicellular/binucleate stages by coordinated harvest after observing flag leaf appearance and spikelet characteristics.

Orchard Knob: The forgotten glades of Chattanooga and an update on *Clematis fremontii* populations in Tennessee. ***Alaina Krakowiak*, John Shelton*, and Joey Shaw,*** *The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Orchard Knob Reservation, a branch of the Chickamauga and Chattanooga National Military Park only minutes from downtown Chattanooga, houses a rich and unique flora. To date, 180 species (representing 140 genera and 59 families) have been documented from this 2-acre area, including a small population of *Clematis fremontii*, an S1 species in Tennessee. In this study, along with a floristic survey of the site, we explore the area's botanical history using Civil War-era herbarium specimens and historical documents, including letters written between botanists Gattinger and Engelmann. We also present detailed distribution maps of the *C. fremontii* population at Orchard Knob as well as the other known population in Tennessee that we created using GIS, and discuss some of the threats currently facing this rare species.

Applications, methods, and examples of research projects using the burgeoning Southeastern Regional Network of Expertise and Collections database. ***John Shelton* and Joey Shaw,*** *University of Tennessee at Chattanooga, Chattanooga, Tennessee.* SERNEC, Southeastern Regional Network of Expertise and Collections, is an online database that stores herbarium images and associated data from specimens throughout the Southeastern United States and is publicly available for use by researchers globally. Throughout the last year, we have utilized the SERNEC database in five separate research projects centered on geographic specific queries, taxon specific queries, and collector specific queries. In addition to presenting the results of these studies, we will show researchers the methodology behind creating these queries and their usefulness for floristic and geospatial questions.

An overview of Tennessee's herbaria, based on digitized specimens. ***Caleb Powell* and Joey Shaw****, University of Tennessee at Chattanooga, Chattanooga, Tennessee.* In 2015, an NSF-funded effort was begun to digitize and skeletally database all of Tennessee's herbarium collections, except non-North American specimens at TENN and VDB-BRIT. Currently, many Tennessee herbaria are finished with the digitization process and we anticipate the remainder complete by summer 2019. These data, which are available on open access portals such as SERNEC and iDigbio, make a wide scope analysis feasible. Seeking to aid future botanical research projects in prioritizing the most impactful opportunities, we present an overview of Tennessee's vascular plant collections, which can be characterized with respect to geographic and taxonomic boundaries. Additionally, as specimen digitization is occurring nationally and internationally, we now have the unique opportunity to assess large numbers of specimens previously outside of the reach of Tennessee's botanists. We will also present a summary of all digitized specimens collected in, but not necessarily housed in Tennessee herbaria.

Evaluating the ranks of the Tennessee Invasive Plant Council using herbarium specimen data from the developing SERNEC database. ***Courtney Alley* and Joey Shaw****, The University of Tennessee at Chattanooga, Chattanooga, Tennessee.* Non-native invasive plant species are a substantial threat to the native flora and native ecosystems in Tennessee and as such they are a problem for conservation. As a first line of defense, organizations such as the Tennessee Invasive Plant Council (TN-IPC), work to list and rank non-native plant species. Up until recently, organizations such as these have relied heavily on expert opinion and experience to rank non-native species. However, with the onset of metadata technology, the ability to access large amounts of information has transformed the ways in which we can enhance our understanding of the threat of non-native species. In December 2017, we searched the SERNEC database for all herbarium specimens of the 486 non-native species of Tennessee that were collected within the political boundary of Tennessee. This search revealed major discrepancies between TN-IPC's ranking system and the frequency of documentation of these species throughout the state. Data collected revealed that 5 species on the list have been recorded in less than 10 counties across Tennessee, a significant number. One of two requirement for a plant to be considered an established threat is being found in 10 or more counties (the other condition being that the plant cannot be eradicated with available methods). Therefore, 5 of the 40 species that TN-IPC considers an established threat meet only half the requirements for this ranking. This study demonstrates the extent to which new, metadata-based tools can be utilized to reevaluate the distributions of non-native plant species and ultimately test the TN-IPC ranking system through predictive modeling.

Impacts of nutrient enrichment of the Harpeth River in Middle Tennessee by the Franklin Wastewater Treatment Facility on the composition of algae assemblages. ***Jefferson Lebkuecher, Sandra Bojic*, Cooper Breeden*, Samantha Childs*, Matthew Evans*, Bailey Hauskins*, Zach Irick*, Josh Kraft*, Jonathan Krausfeldt*, and Nicole Santoyo*,*** *Austin Peay State University, Clarksville, Tennessee.* The concentration of phosphorus of water samples, biomass of periphyton, and composition of soft-algae and diatom assemblages in the Harpeth River at two sites upstream and two sites downstream of the Franklin Wastewater Treatment Facility were evaluated to assess the impact of nutrient enrichment on the integrity of photoautotrophic periphyton. Nutrient impairment of all four sites was

indicated by eutrophic concentrations of phosphorus of water samples and periphyton biomass. Percent composition of 186 taxa of algae were documented; 92 taxa of soft algae and 94 taxa of diatoms. Analyses of algae composition by indices including the algae trophic index for soft-algae assemblages and the pollution tolerance index for diatom assemblages indicate biotic impairment by nutrient enrichment was greatest at the river site located immediately downstream of the wastewater treatment facility. The results indicate that degradation of water quality by the wastewater treatment facility alters the composition of photoautotrophic periphyton.

The Tennessee Plant Conservation Alliance: a collaborative statewide initiative working toward effective conservation. ***Cooper Breeden,*** *Austin Peay State University, Clarksville, Tennessee.* The Tennessee Plant Conservation Alliance is a collaborative initiative that connects university programs, botanical gardens, government agencies, land managers, environmental consultants, botanical experts, and volunteer naturalists to facilitate the conservation of rare plants and communities across the state. With over 500 rare plants in Tennessee, such a coalition of organizations and individuals dedicated to the conservation of Tennessee's rare plants is essential. Though in its infancy, the TPCA has a list of priority species for which projects will begin in its first year. One such species is *Trifolium calcaricum*, and the work done surrounding the conservation of this species serves as a model for future conservation projects across the state. The work has involved the cooperation of state agencies, civic groups, nurseries, and all of it has been led by a dedicated volunteer. The project is still underway and will likely involve several other partners from various sectors working together.

Cell and Molecular Biology

Section Chair: Roger Jackson

Pharmacological disruption of the microtubule array to determine the role of Golgi-nucleated microtubules in cancer cell migration. ***Briar Bell* and Sarah Lundin-Schiller,*** *Austin Peay State University, Clarksville, Tennessee.* Golgi-nucleated microtubules (MTs) polarize toward a leading cellular edge and are involved in transport of signaling molecules which interact with extra cellular matrices; thus, implicating them in directed cell migration. Previous work revealed increased Golgi-nucleated MTs in cells with aggressive migratory behavior and cells treated with epidermal growth factor. This work aims to determine if Golgi-nucleated MTs contribute to cell migration by utilizing a scratch wound assay with pharmacological agents targeting Golgi and microtubules. In a less invasive cell type, neither Golgi-MT (control: n=40, Golgi-disrupted: n=45; p=0.0572) nor cell-wide MT disruption (control: n=40, MT-disrupted: n=55; p=0.2583) affected migration. In a more aggressive cell type, both Golgi-MT (control: n=60, Golgi-disrupted: n=55; $p<0.0001$) and cell-wide MT disruption (control: n=60, MT-disrupted: n=55; $p<0.0001$) affected directed cell migration. Golgi-MT disruption did not reduce migration as much as cell-wide MT disruption (Golgi-disrupted: n=55, MT-disrupted: n=55, $p<0.0001$). These results support the hypothesis that Golgi-nucleated microtubules play a role in directed cell-migration.

Identification of motif and transcription factor binding sites in *Panicum hallii* by ChIP sequencing analysis. ***Shohana Huq** and *Suping Zhou,*** *Tennessee State University, Nashville, Tennessee.* ChIP sequencing analysis is an important way to study motif binding sites, because it allows obtaining more sites than the actual transcription factor binding sites themselves and let to discover actual binding specificity of the TF investigated in the experiment. In our experiment, 227 motifs were counted from the control (850) and drought treated (31635) ChIPed sequences through JASPAR CORE databases. Among these 32 and 39 (control and drought respectively) motifs matched genome wide with other eukaryotic known motifs. Motif discovery was done by MEME- ChIP and DREME motif tool discovery analysis and the logo alignments of the motif comparison analysis were done by Tomtom software. We identified six candidate Transcription factors from the drought treated samples and one from the control samples after drought stress treatment by Chip sequencing analysis. These TF are Involved in ABA-mediated stress-signaling pathway, in hormonal signal transduction, binding other consensus sequences and in cell differentiation processes.

Chemistry

Section Chair: Wilson Gichuhi

Picotechnology and Quantum Atomics. ***Preston J. MacDougall,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Nanotechnology investigates matter at the nanometer scale and engineers systems that take advantage of properties of matter at that scale; molecular engineering. Similarly, "femtotechnology" investigates matter at the femtometer scale and engineers systems that take advantage of properties of matter at that scale; nuclear engineering. Picotechnology investigates matter at the picometer scale and will allow engineering of systems that take advantage of properties of matter at that scale; atomic engineering. Bader's Quantum Theory of Atoms In Molecules allows for the definition of well-defined, measurable, reproducible, and often transferable properties of atoms in molecules. Such data can be classified as quantum atomics, and is analogous to other –omics such as genomics, proteomics, etc... While any molecular property can be rigorously partitioned into atomic contributions, we'll focus on subatomic features that are well-defined (by the topological

properties of the Laplacian of the electronic charge density), measurable, reproducible, and often transferable.

Wavelength-scanned cavity ring-down spectroscopic measurements reveal strong carbon dioxide (CO_2) to carbon monoxide (CO) correlation in the Highland Rim Region. ***Lahiru P. Gamage* and Wilson K. Gichuhi,*** *Tennessee Technological University, Cookeville, Tennessee.* Carbon Monoxide (CO) enters into the environment mainly through the incomplete combustion of hydrocarbons from anthropogenic sources. On entering the troposphere, CO reacts with OH radicals, reducing the number density of OH radicals that would have otherwise been available to react with Methane (CH_4). It is through this process that CO is considered an indirect contributor to global warming. In this work, a Wavelength-Scanned Cavity Ring-Down Spectroscopic technique (WS-CRDS) is utilized to acquire simultaneous mixing ratio measurements of CO_2 and CO in the Eastern Highland Rim region (36.1628° N, 85.5016° W). By examining the seasonal correlation between CO_2 and CO as given by the CO:CO_2 ratio, important information about CO and CO_2 co-emission and anthropogenic sources of CO_2 can be revealed. The CO:CO_2 ratio (ppm:ppm) for each season is determined by using a regression analysis method where a CO:CO_2 ratio of 0.00612 ($R^2 = 0.9$), 0.00422 ($R^2 = 0.8$), 0.00356 ($R^2 = 0.8$) and 0.00112 ($R^2 = 0.2$) is obtained for Winter, Fall, Spring and Summer seasons, respectively. The seasonal and atmospheric gas transportation trends under the influence of wind are finally corroborated by performing NOAA HYSPLIT trajectories.

A comparison of iodine clock reactions using varied strengths of acids. ***Caileigh Lavigne* and Marcia Schilling,*** *Austin Peay State University, Clarksville, Tennessee.* Traditional iodine clock reactions with varied reactant concentrations are used to determine a rate law to better understand kinetics. Reactions with constant concentrations while varying the temperature at which the reaction occurs is used to determine the activation energy (E_a) using the Arrhenius equation. In this study, iodine clock reactions were varied with acids of distinct dissociation constants (K_a) to understand the effect of equilibrium on the kinetics and activation energies.

Environmentally friendly gold nanoparticles for catalytic applications. ***Allison N. Schmittou*, Juan Soto, Peter J. Ponce II, and Rajalingam Dakshinamurthy,*** *Austin Peay State University, Clarksville, Tennessee.* Gold nanoparticles (AuNPs) offer a multitude of uses in industry, a prime example of which is catalysis of toxic waste products into non-toxic derivatives. Nitrophenols are among the most common waste products found in industries such as plastics, explosives, and dye making. The reaction of 4-nitrophenol (PNP) into 4-aminophenol (PAP), then, is a prime candidate for studying the catalytic differences of AuNPs capped with varying ligands. However, to ensure that the product remains non-toxic, it is necessary to produce a biologically safe nanoparticle. Using saccharides as both a reducing and capping agent accomplishes this goal and allows for a direct, one-step synthesis of particles with a size of approximately 20 nm. The type of saccharide on the particle directly influences its catalytic activity with prior research showing that rate constants increase as ligand size decreases. For this investigation, maltose, a reducing disaccharide, was used. The rate constant of Mal-AuNPs was determined.

Antibacterial activity of antibiotic coated gold nanoparticle. ***Purva Patel*, Peter J. Ponce II*, Allison N. Schmittou*, Juan Soto*, Ahrang Yee*, Sergie Markov, and Rajalingam Dakshinamurthy,*** *Austin Peay State University, Clarksville, Tennessee.* Antibiotics and some similar kind of drugs, together known as antimicrobial agents, have been used over last 70 years to treat people with infectious diseases. These drugs have reduced the rate of illness and mortality for almost four decades. However, the prolonged and wide usage of these antibiotics have made the infectious organisms resistant to it. There are several ways in which bacteria can become resistant to an antibiotic. Some neutralize the antibiotic and change its way to make it harmless, whereas the others pump the antibiotic outside the bacteria before it can damage. There are also certain bacteria which undergo morphological changes so that an antibiotic cannot attach themselves to the bacteria to kill it. This has increased the demand for new antibiotics to treat the multi-drug resistant bacteria. An alternative route has been explored to modify commercial antibiotics by capping them with gold nanoparticles. A biosynthetic process was used to synthesize Oxytetracycline-AuNP. Four different bacterial strains were used to study antibacterial activity and mechanism of OxyT-AuNP: *Escherichia coli* (gram negative), *Enterobacter aerogenes* (gram negative), *Bacillus subtilis* (gram positive), and *Staphylococcus aureus* (gram positive). MIC (minimum inhibitory concentration) testing of OxyT-AuNP against all the four bacterial strains was performed. For gram negative bacteria like *Escherichia coli* and *Enterobacter aerogenes* MIC for OxyT-AuNP was lower than OxyT only. For gram positive bacteria like *Bacillus subtilis* and *Staphylococcus aureus* MIC for OxyT-AuNP was higher compared to OxyT only. Future studies including mechanism of OxyT-AuNPs will be evaluated against bacterial strains using several assays.

Synthesis of unsymmetrical 1,10-bis(4-alkoxypyridinium [*closo*-$B_{10}H_{10}$]$^{2-}$ derivatives. ***Anas N. Hajhussein*, Loay S. Abuzahra*, Andrienne C. Friedli, and Piotr Kaszynski,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Liquid crystals (LCs) are electroactive materials used in display screens. LCs have at least one additional phase between the solid and liquid phases. Highly polar LCs often have more organized phases due to strong intermolecular attractive forces. A series of highly polar bispyridinium derivatives of boron *closo* clusters, [*closo*-$B_{10}H_{10}$-1,10-2(4-$OC_nH_{2n+1}C_5H_4N$)] (**1[n]** n=6, 8-12, 14, 16, 18) show two to five LC phases. Here we report the synthesis of an

unsymmetrical series [*closo*-$B_{10}H_{10}$-1-(4-$OC_8H_{17}C_5H_4N$)-10-(4-$OC_nH_{2n+1}C_5H_4N$)] (**2[8,n]**. Using a literature procedure, [*closo*-$B_{10}H_{10}]^{2-}$ [$2Pr_4N^+$] (**3**) was converted to [*closo*-$B_{10}H_{10}$-1- PhI]$^-$ [$Pr_4N]^+$ (**4**) in 65% yield. Compound **4** was then reacted with 4-octyloxypyridine (**5[8]**) to give [*closo*-$B_{10}H_{10}$-1-(4-$OC_8H_{17}C_5H_4N)]^-$ [$Pr_4N]^+$ (**6[8]**), followed by $PhI(OAc)_2$, to give [*closo*-$B_{10}H_{10}$-1-PhI-10-(4-$OC_8H_{17}C_5H_4N$)] (**7[8]**). This key intermediate was treated with several even 4-alkoxypyridines **5[n]**, to give **2[8,n]**. The phase behavior of highly purified **2[8,n]** will be measured using Differential Scanning Calorimetry and compared to **1[n]**.

Synthesis of long-chain alkylbenzenes on heterogeneous superacidic catalyst. ***Anastasia A. Kuvayskaya* and Aleksey Vasiliev***, *East Tennessee State University, Johnson City, Tennessee*. Phosphotungstic acid $H_3[PW_{12}O_{40}]$ (PTA) with the Keggin structure has become well known as a solid superacid with pKa≈-13. However, wide application of pure superacids in heterogeneous catalysis is limited by their low surface area and solubility in polar solvents. The objective of this work is the synthesis and study of insoluble superacidic catalyst containing PTA embedded into the silica matrix. The catalyst was synthesized by the sol-gel method. Tetraethoxysilane was co-condensed with PTA in acidic media in the presence of Pluronic P123 surfactant. The obtained gel was air-dried and calcined at 500 °C producing mesoporous materials with a significant fraction of micropores in their structure. The catalyst was successfully tested in the alkylation of mesitylene by 1-decene in liquid phase at 100-160 °C. The activity of PTA/ SiO_2 in this reaction was comparable with zeolite HY and significantly higher than high-silica zeolite. Alkylation resulted in a mixture of isomeric alkylbenzenes.

Ecology and Environmental Science

Section Chair: Brent C. Newman

Using EDX to find the nutritional quality of elk forage, Pineville Kentucky. ***Tanner Denton* and Dr. LeRoy Brandt,*** *Lincoln Memorial University, Harrogate, Tennessee*. Mountaintop removal mining has had a notable impact on the Appalachian landscape. Many reclaimed mining sites have been utilized to re-establish elk populations within the region. With these extensive changes to the landscape, we investigated the impact that a history of mountain removal might have on the micronutrient availability for elk foraging on a reclaimed mine near Pineville, KY. Using energy dispersive spectroscopy (EDX), we measured the micronutritional content in the root tips of grasses and forbs that had been eaten by elk. We used a 4-way nested ANOVA to evaluate elk foraging based on sample location, plant type, and micronutrients present. Our results indicate no statistical differences based on elk foraging. However, differences were noted by collection sites, and by root section (distance from the root tip).

Assessing growth and recapture of Cumberlandian Combshell mussels, *Epioblasma brevidens*, stocked in the Powell River, Tennessee. ***R. Jones* and A. Vanderpool***, *Lincoln Memorial University, Harrogate, Tennessee*. The Powell River is one of the most ecologically diverse habitats in the United States. Historic industries such as coal mining, logging, and agriculture have caused long term ecological effects on the river's health. Many mussel species, such as the Cumberlandian combshell, are currently federally listed as endangered. This study focuses on the use of PIT tags to evaluate Cumberlandian combshell mussel growth and recapture rates for juveniles stocked into the Powell River in support of restoration efforts. Sampling effort data is being compiled for use in a Bayesian Model, as well as an analysis of variance. Data collection focuses on growth patterns, as well as recapture rates as is expected to be complete in October, 2018.

Incidence of pharmaceuticals in a river drained by a rural watershed. ***Ravneet Kaur*, Anonya A. Amenyenu, and Sam Dennis***, *Tennessee State University, Nashville, Tennessee*. Pharmaceuticals have been detected nationwide in the environment including surface water. The objective of this study was to qualitatively detect the presence of pharmaceuticals in Collins River. Collins River is a six-order river drained by a rural watershed. Grab water samples were collected for three seasons (summer 2014 to winter 2016). Simultaneously, water quality parameters were determined in situ using multi-parameter sondes. The water samples were analyzed for the presence of pharmaceuticals using GC-MS. The pharmaceuticals detected included those used for chronic alcoholism, anti-diabetic drug, antibiotic drug, and anti-inflammatory conditions. While the quantitative concentrations of these drugs were not determined in this study, their qualitative presence in surface water is noteworthy.

Examining fish species richness and abundance in a reclaimed mountaintop removal mining watershed. ***Kayla D. Howard and Agnes Vanderpool,*** *Lincoln Memorial University, Harrogate, Tennessee*. The purpose of this research is to determine the species diversity, richness, and abundance of the fish community in Cranes Creek in Bell County, Kentucky. Cranes Creek is a second-order stream located in a watershed that is thirty years post reclamation. Objectives include determining whether fish populations have recovered since reclamation, and to conduct a survey to determine community diversity and richness in a stream for which only limited records exist. Collection methods include electrofishing three sections of Cranes Creek. Data collection will be finalized in October 2018. It is expected that fish community diversity and richness will be similar to mountain headwater streams in neighboring watersheds that have experienced less disturbance due to mining activity.

Detection and habitat modeling for the state threatened Western Pygmy Rattlesnake (*Sistrurus miliarius streckeri*) in Tennessee. ***Shawn D. Snyder* and William B. Sutton***,

Tennessee State University, Nashville, Tennessee. Globally, reptile populations are declining at a rate quicker than most other vertebrates. The Western Pygmy Rattlesnake (*S. miliarius streckeri*) occurs in a narrow range in west-central Tennessee along the Tennessee River drainages and Western Highland Rim. Little is known about the spatial ecology or habitat requirements of this species in Tennessee where it is listed as State Threatened. Previous studies on this species have reinforced the rarity of this species in the state with as little as 30 confirmed occurrences coming in the last 30 years. Our primary research objectives are to evaluate the distribution of the Western Pygmy Rattlesnake in Tennessee by using a variety of field-based survey methods and species distribution modeling techniques. Our preliminary habitat suitability model suggests most of the suitable habitat, for pygmy rattlesnakes in Tennessee occurs on the East side of the Tennessee River and is predominantly associated with riverine and stream systems.

Does the Louisiana Waterthrush (*Parkesia motacilla*) avoid nest predators in Central Tennessee? ***Sylvia D. Powell* and Stefan Woltmann,*** *Austin Peay State University, Clarksville, Tennessee.* We know little about whether Louisiana Waterthrush (*Parkesia motacilla*) can position nests where predation risk is lower. Socially monogamous pairs have territories along streams used for foraging and build nests in stream banks. We observed Louisiana Waterthrush nesting along minor tributaries rather than the main stems of streams used for foraging, and we hypothesize this is an adaptive behavior to avoid nest predation. We are using an experiment with artificial nests to explore whether minor tributaries are safer nesting locations. We are identifying potential predators with trail cameras at both natural and artificial nests. Preliminary findings suggest a variety of potential nest predators, such as the Eastern Chipmunk (*Tamias striatus*), Virginia Opossum (*Didelphis virginiana*), and Raccoon (*Procyon lotor*).

Assessing effectiveness of PIT tags for recapture of an endangered freshwater mussel, *Epioblasma capsaeformis,* released into the Powell River, Tennessee. ***Michelle A. Russell* and Aggy Vanderpool,*** *Lincoln Memorial University, Harrogate, Tennessee.* Freshwater mussels play a valuable role in the ecosystems they inhabit. The Powell River of East Tennessee hosts one of the most diverse communities of freshwater mussels in the world including 36 species, 13 of which are listed as federally endangered. This project supports current restoration efforts by multiple state and federal agencies for the oyster mussel, *Epioblasma capsaeformis,* in the Powell River, Tennessee. The purpose of the study is to assess growth and percent recapture rates for PIT-tagged juvenile oyster mussels stocked in the Powell River in September 2017.

Ecosystem Restoration at Kilbride Nature Sanctuary. ***Patricia Cole,*** *Tennessee Wesleyan University, Athens, Tennessee.* Tennessee Wesleyan University (TWU) recently began restoration of a 92-acre site in Rhea County that was farmed intensively for decades, including row cropping and clear cutting. The site is half wooded and half open, with roughly 1.25 miles of edge habitat between forest and field. Chinese privet (*Ligustrum sinense*), which is especially well-adapted to edge habitat, has invaded and established a tall, dense thicket along most of the forest-field border, and both privet and the non-native invasive grass *Microstegium vimineum* have invaded the forest interior as well. Privet and *M. vimineum* removal and thinning of certain tree species to allow for regeneration of the native oak-dominated forest was undertaken by a variety of methods, and native tree, grass, and forb species will be planted to improve wildlife habitat. In summer 2018 TWU students and faculty collected data on tree species composition to establish a baseline for monitoring native habitat regeneration.

Engineering and Engineering Technology

Section Chair: Ahmed ElSawy

Automation of nutrient injection system in hydroponics system. ***Hannah Burns*, Michael Colby, Austin Ribley, Daniel Schlenker, Garrett Thompson, Elijah White, Michael Best and Ahmed ElSawy,*** *Tennessee Technological University, Cookeville, Tennessee.* Hydroponics is the cultivation of plants by placing the roots in liquid nutrient solutions instead of soil. The controlling factors of this automated hydroponic system are the water/nutrient flow rate, pH (water acidity), and EC (nutrient presence). Traditionally, farmers manually regulate the water/nutrient flow rate through the plants' roots. Slow water/nutrient flow rates cause the growth of algae and if the flow is too fast, the plants will not absorb nutrients and die. The goal of this project is to automate the flow of the water/nutrients, testing if the pH and EC, and adjusting accordingly. A Raspberry Pi was used to program the pH and EC sensors that are suspended in the water-holding tank. The nutrients are pumped to the water in the predetermined amount to adjust the water/nutrient ratio. Once the pH and volume of water/nutrients are correct, the water/nutrients flow through the plumbing system, which holds the plant cups, and back into the water-holding tank; then the process repeats.

Automation of the biodiesel processing by using sonication and electrostatic for increasing the yield and faster glycerol separation. ***Robbie Mannankara*, Anthony Taylor, Caleb Parker, Kareem Williams, Warren Klapp, Saanyol Igbax* and Ahmed Elsawy,*** *Tennessee Technological University, Cookeville, Tennessee.* Production of biodiesel from waste vegetable oil (WVA) is an economical and environmentally benign option to use as an alternative energy source and reuse of waste vegetable oil. This study has two objectives: 1) increasing the biodiesel production rate and 2) reducing the processing time. These two objectives were achieved using

sonication to accelerate the WVO and methoxide and high voltage was used to accelerate the separation of the glycerin from the biodiesel. The system was automated using a Raspberry Pi 3 Model B for better process control and allow simultaneous tasks to be executed. With the addition of a second separation tank, the process can be used for continuous production. This paper will discuss the system design, automation, results and suggestions for future improvement.

Characterization of mechanical properties and microstructure of wire+arc additively manufactured parts. ***Taylor Ross*, Peyton Hunt*, Md. Ahsan*, Ali Tanvir*, Ahmed Elsawy, and Duck Bong Kim,*** *Tennessee Technological University, Cookeville, Tennessee.* Wire+arc additive manufacturing (WAAM) utilizes existing welding technology to make a part from metal deposited in a near-net shape fabrication. In this work, a gas metal arc welding (GMAW) based two robot-based WAAM system has been developed to exploit the flexibility of the process and is used for studying the mechanical properties and microstructure analysis of metal alloys: low carbon steel and AISI 316L stainless steel. The microstructural features and mechanical properties are studied in-depth using a scanning electron microscope (SEM), micro-hardness, and tensile testers. The results show that two alloys can be fused successfully without any defects. Although a similar welding strength has been attained in WAAM, the ductility is found to be significantly lower. In conclusion, the feasibility of the system and its process have been demonstrated for industrial applications. In the near future, heat-treatment of the deposited parts will be performed to improve yield strength and ductility.

Detection of cyber physical system attack using monitoring signal. ***Mohammad A. Rahman*, Liang Hong, and L.H. Keel,*** *Tennessee State University, Nashville, Tennessee.* In this work, we consider a detection mechanism that can detect whether the integrity of the physical system has been compromised. Attacks on the system integrity result in a change of dynamical property of the system that leads to undesirable behavior, which is harmful for the system. The proposed technique uses a hidden monitoring signal that does not affect the performance of the system and works on the live system. We also show that a certain type of attacks on signals/data can be modeled as an attack on the system integrity and therefore the technique can be used. The effectiveness of the technique will be shown by examples.

In-Situ evaluation of attic radiant barrier assemblies. ***David W. Yarbrough*, Khar San Teh, and Chin Haw Lim,*** *R&D Services, Inc., Cookeville, Tennessee, and Solar Energy Institute, Universiti Kebangsaan, Bangi, Malaysia.* Attic radiant barriers, materials with a low-emittance surface, are an energy conserving concept that is widely used in U.S. climate zones 1-3. Attic radiant barriers are now being used in many parts of the world including SE Asia. Quantitative evaluation of these barriers is difficult since the performance varies with time of day and season. As a result, energy savings or thermal resistance determinations are undertaken with actual structures exposed to the environment for extended periods, field studies. A small-scale field study has been underway in Malaysia to determine thermal resistance equivalents from transient heat-flux data. Results for the attic radiant barrier installations range from 2 to 3 $m^2 \cdot W/K$ (R-values 11 to 17 $ft^2 \cdot h°F/Btu$) for heat flow down. The project and selected results will be discussed in this presentation.

Design labs for electromechanical devices and instrumentation. ***Russ Longhurst****, *Austin Peay State University, Clarksville, Tennessee.* For practicing engineers, often they must design devices and systems that are multidisciplinary in nature. This requires integrating electrical and mechanical components into a single unit. In recent years, the mechatronics field has formed to integrate these disciplines. Sometimes by necessity, their design process focuses more on the integration of components and not as much on the design of the components. The design of components has traditionally been performed by the discipline specific professionals such as mechanical or electrical engineers. To provide engineering students with a multidiscipline design experience, labs assignments have been created that require students to perform component level design as well as integration between the mechanical and electrical components. The presented labs require the design, build, and performance testing of a strain-gauge-based load cell, D.C. motor, and a servo control system. The labs have shown to provide students with a challenging and practical design experience.

Capstone to career. ***Eric S. Friend* and Chin-Zue Chen,*** *Austin Peay State University, Clarksville, Tennessee.* Rapid advancements in technology has resulted in automation becoming mainstream within manufacturing industry. Robots integrated with Mechatronics systems continue to replace humans in the workplace. This affects employees with limited skillset's and where the four Ds' of robotics can be applied (Dangerous, Difficult, Dirty, Dull). This movement of increased automation has created a demand for employees with skills in many different curriculums such as: Programmable Logic Controllers, Control Systems, Robotics, Mechatronics, and Manufacturing. Each day at my job, I use much of the knowledge I gained while attending Austin Peay State University. In this presentation, the presenter will provide an inside look at a capstone project and how it applies to his career.

Autonomic function assessment in Alzheimer's patients with yoga practicing using kernel method and entrainment techniques. ***Ahmed K. Kamal****, *Tennessee Technological University, Cookeville, Tennessee.* The experimental procedure of lowering and raising a leg while the subject in supine position is considered to stimulate and entrain the auto-

nomic nervous system of fifteen patients with Alzheimer's disease practicing Yoga and fifteen age and sex matched control Alzheimer's disease non Yoga practicing patients . The assessment of autonomic function for each group is achieved using an algorithm based on Volterra kernel estimation. By applying this algorithm, the model for each group contains the linear part (first order kernel) and quadratic part (second order) kernel .The results show significant difference in first order kernel (impulse response) and second order kernel (mesh diagram) for each group. Using first order kernel and second order kernel, it is possible to assess autonomic function qualitatively and quantitatively in both groups.

Potential associated eye and certain other health symptoms while driving or occupying a vehicle. ***Louise Katz, Jenny Holcombe, Glenn Hudson, and Frank Andrasik,*** *Columbia State Community College, Columbia, Tennessee (LK, GH), University of Tennessee at Chattanooga, Chattanooga, Tennessee (JH), and The University of Memphis, Memphis, Tennessee (FA).* This paper provides results of a survey (N= 982) to determine the extent of potential health symptoms for persons driving or occupying a vehicle while the vehicle is in motion with particular interest in the possible effects of modern windshields due to optical aberrations and imperfections in the manufacturing process. Symptoms of interest were headache or pain in the head, problem focusing the eyes, pain in or around the eyes, nausea or vomiting, dizziness, balance problem, not being able to see things ordinarily can see, and feeling vision is worse. Overall, 66.9% of all respondents reported experiencing at least 1 symptom and 23.7% reported experiencing 4 or more symptoms. Respondents who were in a front seat were significantly more likely to report headache or pain in the head, problem focusing the eyes, and feeling vision is worse. Many other statistically significant results were found and possible relationships with accidents.

Geology and Geography

Section Chair: Lisa Mayo

Results of microcystin toxin and nutrient analysis in the TSU wetland. ***Rodney Blackwell, Jr.*, De'Etra Young, Taylor Ribeiro and Tom D. Byl,*** *Tennessee State University, Nashville, Tennessee (RB, DY, TR), U.S. Geological Survey, Nashville, Tennessee (TDB).* Cyanobacteria capable of producing cyanotoxins flourish in the Tennessee State University wetland in Nashville, TN, posing a danger to livestock and wildlife. The objective of this research was to measure microcystin and water chemistry to determine trends through time. Samples were collected at four wetland locations between 2017 and 2018 and analyzed for nutrients (nitrogen, phosphorous, iron, sulfur), Secchi depth, type of algae present, and microcystin. Continuous water-quality instruments were also installed at the inlet and outlet to document dissolved oxygen, pH, temperature, specific conductance and turbidity. Seven cyanobacteria genera capable of producing cyanotoxin were identified in the wetland. The microcystin concentrations ranged from less than 0.15 to 10.6 µg/L. The highest concentrations of toxin were located near the livestock access point. The peak microcystin concentrations were well above the US EPA's health advisory concentration of 0.3 µg/L. Additional work includes correlations between water chemistry parameters and cyanotoxin concentrations.

Paleoliquifaction features in the Newton Sandstone (Lower Pennsylvanian) near Spencer, Tennessee. ***Michael A. Gibson,*** *The University of Tennessee at Martin, Martin, Tennessee.* The Newton Sandstone is a capstone on the Cumberland Plateau. The Newton consists of thin- to thick bedded, orange-pink weathering, fine- to medium-grained, cross-bedded quartz sandstone. Four oval depressions (6-8 feet across) occur approximately 25 feet above road level. The depressions are elongate horizontally, have smooth walls, and were infilled with orange clay (mostly eroded due to highway cutting). A distinctive "growth faulting" style jointing connects the depression to the underlying Whitwell Shale and shows local sagging of the base of the Newton down into the Whitwell immediately adjacent to the "growth faulting". The features are interpreted as paleoliquifaction within the Whitwell and Newton attributed to subsidence of the sandstones into the underlying mobile mud of the Whitwell that subsequently rose upwards into the Newton to a distance that equalized density according to isostasy, at which point the clay mud mushroomed laterally to create oblong clay lenses within the Newton.

Promoting diversity in the geosciences through university - government partnerships. ***Tom D. Byl, De'Etra Young, Jessica Oster, Rickard Toomey, and Eleanour Snow,*** *U.S. Geological Survey, Nashville, Tennessee (TDB, ES), Tennessee State University, Nashville, Tennessee (DY), Vanderbilt University, Nashville, Tennessee (JO), Mammoth Cave National Park, Mammoth Cave, Kentucky (RT).* The National Science Foundation (NSF) reports that geosciences are the least diverse of all the STEM majors. A recent article reports there has been no progress in diversifying the earth sciences despite 40 years of diversity programs. Students at historically black colleges and universities and other minority-serving institutions do not have access to the full suite of earth sciences curriculum required to pursue employment or advanced degrees in geoscience. TSU and Vanderbilt University recently received a NSF GeoPaths grant that focuses on bringing a geoscience curriculum to TSU. The U.S. Geological Survey and Mammoth Cave National Park are actively partnering with these universities to help support this new curriculum. This partnership—called Earth Horizons—will provide students with seminar experiences, geoscience courses, experiential learning, and interactions with professional geoscientists. Earth Horizons will introduce under-represented students to geoscience

opportunities while providing a strong foundation for earth science careers.

Health and Medical Sciences

Section Chair: Julie Phillips

Inactivation of wild-type and acid-adopted *Salmonella* serovars and *Escherichia coli* O157:H7 using high pressure pasteurization. ***Jayashan Adhikari and Aliyar Fouladkhah***, *Tennessee State University, Nashville, Tennessee.* Non-typhoidal *Salmonella* serovars and *Escherichia coli* O157:H7 are currently leading etiological agents for food-borne hospitalizations and deaths in the United States. Current study discusses laboratory microbiological challenge studies for inactivation of the two pathogens of public health concern exposed to various times (30 seconds to 8 minutes) and intensity levels (0 to 650 MPa) of elevated hydrostatic pressure. Under condition of experiments, at 380 MPa, for treatments of 30 seconds to 8 minutes, D-value of 1.19 and inactivation K_{max} value of 2.87 were observed for *Salmonella* serovars. Up to 6.2 log CFU/mL reductions ($P<0.05$) of habituated *Salmonella* serovars at planktonic stages were achieved using application of pressure at 380 MPa for 8 minutes. Results of this study could be incorporated as a part of predictive public health microbiological modeling and risk assessment analyses for prevention of infections cause by Non-typhoidal *Salmonella* serovars and *Escherichia coli* O157:H7.

Prevention of planktonic and sessile foodborne pathogens of public health concern using an emerging technology. ***Abimbola Allison*, Shahid Chowdhury, and Aliyar Fouladkhah***, *Tennessee State University, Nashville, Tennessee.* Epidemiological evidenced derived from active surveillance data of Centers for Disease Control and Prevention indicate more than 3,000 premature mortality occurs in the United States due to foodborne diseases every year. Current study investigates effects of elevated hydrostatic pressure for decontamination of various products from planktonic and sessile cells of *Salmonella* serovars, *Listeria monocytogenes*, *Cronobacter sakazakii*, and various serogroups of Shiga toxin-producing *Escherichia coli*. Our studies indicate in excess of 5 log reduction ($P<0.05$) of the pathogens in various biotic environments is achievable using an optimized pressure-based interventions. Our presentation further discusses the ecology of pressure-stressed phenotypes of the above-mentioned bacteria in planktonic and sessile stages.

Pressure-based inactivation of rifampicin-resistant *Cronobacter sakazakii* in infant formula. ***Monica Henry*, Shahid Chowdhury, and Aliyar Fouladkhah***, *Tennessee State University, Nashville, Tennessee.* In vast majority of episodes, infections caused by *Cronobacter sakazakii* are fatal in infants born premature particularly those younger than two months. Tennessee has experienced two outbreak episodes of *Cronobacter sakazakii* associated with infant formula in 1988 and 2001. Current study investigated effects of pressure-based pasteurization at 4 and 50 °C for inactivation of *Cronobacter sakazakii* in reconstituted infant formula. During treatments at 380 MPa at 4 °C, 1.59 and >6.01 log CFU/mL of inoculated pathogen were reduced ($P<0.05$) after 1- and 10-minute treatments, respectively. Overall, our results indicate over 5-log reduction (99.999%) of *Cronobacter sakazakii* in reconstituted infant formula is achievable as result of optimized pressure-based pasteurization that could be utilized to assure safety of infant formula particularly for premature newborns and those with elevated risk of *Cronobacter* infection.

Inhibition of herpes simplex viruses by ginsenoside Rg3. ***Stephen M. Wright***, *Middle Tennessee State University, Murfreesboro, Tennessee.* Herpes simplex virus infections range from self-limiting, benign illness to serious, life-threatening diseases. While nucleotide analog drugs are available, resistance has been increasing and currently there is no vaccine. It would be useful to have additional therapeutic interventions to curtail herpes simplex infection. Natural products have been used for centuries to combat infectious diseases. This study evaluated sixteen compounds from *Panax ginseng* for inhibition of herpes simplex virus. Purified ginsenosides were evaluated for toxicities and inhibition of herpes in Vero cells. Effects of ginsenosides were determined using a PrestoBlue cell viability assay. Ginsenoside Rg3 demonstrated low toxicity and strong inhibition of both herpes simplex virus, types 1 and 2. When Rg3 was used simultaneously with the drug valacyclovir, virus activity ceased completely. The IC_{50} for Rg3 was approximately 45 μM. This ginsenoside shows promise as a potential chemotherapeutic agent against herpes simplex viruses.

History of Science

Section Chair: Martin V. Stewart

It's always the last place you look. ***John J. Schommer***, *University of Tennessee at Martin, Martin, Tennessee.* In constructing a history of science/mathematics, it is only natural to look for sources that are explicitly scientific/mathematical in nature: Aristotle's *Physica*, Euclid's *Elements*, Ptolemy's *Almagest*. Do ancient literary works offer the historian of science any useful information? In this talk we will look at Virgil's *Aeneid* and Augustine's *Confessions* (among others) for clues as to how far scientific/mathematical discoveries may have diffused among the ancient cultural elites.

Contributions of Jeanette Moore King to early science education in Tennessee. ***Martin V. Stewart and Hunter D. Hudson,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* Jeannette Moore King (1870–1965) was one of

the original 18 faculty when Middle Tennessee State Normal School opened in 1911. Although she earned a chapter in Lucille Rogers' book "Light from Many Candles: a History of Pioneer Women in Education in Tennessee" (1960), her legacy is now forgotten, even on the campus that she served so well. This presentation will summarize our progress in reconstructing her life and professional accomplishments, including her role as a close colleague of the first physical science professor at Middle Tennessee State Normal School, Archibald Belcher. A related presentation in the student poster session will include her involvement with the Tennessee Academy of Science as presenter, member of the Executive Board, and Vice President.

Mathematics and Computer Science
Section Chair: Sumen Sen

Modeling the relationship between stock prices and interest rates using Improved Euler's Method. ***Mutiu A Samiyu*, Wasiu Shittu*, and Samuel N Jator,*** *Austin Peay State University, Clarksville, Tennessee.* Interest rate and stock prices are key important factors in the US Capital Market. A judicious manipulation of these two variables has a positive impact on the US economy. It has been established that models such as time series and causality test multivariate, open-economy, short-run model explained the relationship between stock prices and interest rate. This study tends to model the relationship between stock prices and interest rates using Improved Euler's Method (IEM). The Euler's method predicts the stock price value while the improved Euler's is to correct the estimates. The New York Stock Exchange Market data (1997 to 2017) was modeled using the IEM to study the relationship between the variables of interest. Results shows that the IEM provides accurate estimates of the parameters

Numerical integration of time fractional Cahn-Hilliard equation using a hybrid method. ***Amarachi B. Mbakwe*, Samuel N. Jator, and Nicholas O. Kirby,*** *Austin Peay State University, Clarksville, Tennessee.* This paper focuses on the numerical integration of time fractional Cahn-Hilliard equation using a Hybrid method. We show that the equation preserves mass for all positive values of the fractional order α and reduces the free energy. The method has an "off-step" point that increases the order of the method, while preserving good stability property. The construction of the method is based on interpolation and collocation techniques. The accuracy and efficiency of the method is confirmed by comparing it with existing ones in the literature.

A least square improved Euler's method for the Black-Scholes partial differential equation. ***Osazeme Ahanor*, Kazeem Babatunde Tijani, and Jator Samuel,*** *Austin Peay State University, Clarksville, Tennessee.* In this paper, we explore the Black-Scholes Partial Differential Equations by reducing it into a system of Ordinary Differential Equations using the least square method. We then apply the Improved Euler's Method in block form to solve the resulting system. The technique is validated by accurately solving the Black Scholes equation to obtain values of a non-dividend/ dividend paying stock.

On the Block third derivative method for solving hyperbolic partial differential equations with Dirichlet and Neumann boundary conditions. ***Emmanuel Adetayo Akoja* and Samuel N. Jator,*** *Austin Peay State University, Clarksville, Tennessee.* In this paper, we proposed a Block third derivative method for solving hyperbolic partial differential equations (PDEs) with Dirichlet and Neumann's boundary conditions. The method can directly solve hyperbolic PDEs after transforming the PDEs into a system second ordinary differential equations in time variable. This is uniquely different from methods existing in the literature which are solved by reducing them into a first order system. The well-known hyperbolic equations such as Dissipative non-linear wave, and Vander Pol type non-linear wave equations are solved to check the accuracy and efficiency of the proposed method.

A comparison of interest rate models. ***Tinchie F Stevye* and Vajira A Manathunga,*** *Austin Peay State University, Clarksville, Tennessee.* In this research we have summarized popular short rate interest rate models such as Vasicek, CIR, Ho-Lee, Hull-White, Black-Derman-Toy and forward rate model HJM. All models were implemented in R and used to project US interest rates using historical data. Various advantages and disadvantages of these models over each other discussed in detail.

On the evaluation of the American put Black-Scholes equation using an exponentially fitted Enright type method. ***Scott T. Howard* and Samuel N. Jator,*** *Austin Peay State University, Clarksville, Tennessee.* We present an Enright-type second-derivative block numerical integration method, which may in principle be applied to a large class of partial differential equations of various boundary conditions in conjunction with the "method of lines". As a proof of concept, we apply this method to the Black-Scholes BVP with the "American put" boundary conditions using an exponential fit, and discuss the stability and convergence of this method both in general and in the specific case of Black-Scholes.

Pricing bermudan options using option pricing models specific to America and European options. ***Jator Samuel, Israel Olugbade* and Kehinde Ajibade****, *Austin Peay State University, Clarksville, Tennessee.* The Bermudan option is an option the can be exercised at specified intervals, though the Bermudan option is a hybrid of both American and the European option it is usually of less significance when compared to the American and European options. This research is aimed at understanding why the Bermudan

option is less popular amongst investors than American and European options by comparing the advantages and disadvantages of investing in Bermudan options instead of American options or European options, impact of early exercise of Bermudan option as compared to the American options, modeling of American to Bermudan and vice versa, pricing of Bermudian option with various pricing models used in pricing both American and European options and vice versa.

Comparison of computational methods for modeling steady-state heat distribution. ***Lance Schneider* and Daniel Mayo,*** *Austin Peay State University, Clarksville, Tennessee.*

The static distribution of heat on a metallic surface due to a thermal point source has many real-world applications. In materials science, a laser fired at a thin metal plate may find faults within the material by comparing IR camera data with steady-state heat distribution models. For this, model accuracy is of critical importance since thermal distribution changes in the plate due to faults may be very small. Two techniques will be examined. The first will use Mathematica code based on a collocation technique enhanced by Chebyshev basis functions, while the second uses Excel software with a standard Finite Difference method. Approximation error and ease-of-implementation will be compared for both methods.

Doubly-inflated negative binomial regression model. ***Joseph Mathews* and Sumen Sen,*** *Austin Peay State University, Clarksville, Tennessee.* Generalized linear models are an extension of the general linear model in which the response variable is not restricted to be normally distributed. These models are often used for modeling a count response variable where the underlying distribution is assumed to be Poisson or negative binomial. In the case of an excess amount of zero valued counts, both the zero-inflated Poisson and zero-inflated negative binomial regression models have been proposed. A natural extension of zero-inflation models are double-inflation models that model both a zero-valued inflation point and a second, k-valued inflation point. Here we assume a response variable follows a doubly-inflated negative binomial distribution. We model the conditional mean and probability of zero and k-valued counts using covariates. We compare the model to both the standard negative binomial regression and zero-inflated negative binomial regression models using the Akaike information criterion (AIC) and Bayesian information criterion (BIC) on a real-life dataset.

Numerical methods for fractional differential equations. ***P. M. Watkins* and S. Jator,*** *Austin Peay State University, Clarksville, Tennessee.* Some numerical methods are developed to solve initial value problems concerning fractional differential equations. These equations contain fractional order derivatives and can be difficult to handle. The methods developed are tested on some known solutions and evaluated concerning error and other potential problems. In particular, we look at fractional methods based on Euler's method, the trapezoidal rule, and Numerov-type methods. The intent is to eventually solve the fractional partial differential equations through a direct method.

Microbiology

Section Chair: Sergei Markov

The genetic basis of bacterial-induced infertilities in insects. ***Dylan Shropshire*, Daniel LePage*, Sarah Bordenstein, Danny On*, Emily Layton*, Helen Zhou*, and Seth Bordenstein,*** *Vanderbilt University, Nashville, Tennessee. Wolbachia* are maternally-inherited, intracellular bacteria at the forefront of vector control efforts to curb arbovirus transmission. In international field trials, the cytoplasmic incompatibility (CI) drive system of *Wolbachia* is deployed to replace target vector populations, whereby a *Wolbachia*–induced modification of the sperm genome kills embryos. However, *Wolbachia* in the embryo rescue the infertility, and therefore CI results in a strong fitness advantage for infected females that transmit the bacteria to offspring. Despite CI's importance to vector control and speciation, the genetic basis of this trait is unknown. Here we use transgenic and cytological approaches to demonstrate that two genes from *Wolbachia's* prophage are responsible for the sperm modification of CI. We also demonstrate that expressing one of these genes in ovaries independently rescues CI. Our results highlight the central role of *Wolbachia's* prophage in shaping *Wolbachia* phenotypes that are significant to arthropod evolution and vector control.

Lethality induced by pathogen-blocking bacteria increases with grandmother age in *Drosophila melanogaster*. ***Emily M. Layton*, Jungmin On*, J. Dylan Shropshire*, Jessamyn I. Perlmutter*, and Seth R. Bordenstein,*** *Vanderbilt University, Nashville, Tennessee. Wolbachia,* a pathogen-suppressing *α-proteobacteria* inhabiting 40-65% of all arthropod species, dominate vector control efforts combating Zika, dengue, Malaria and other diseases in addition to being implicated in speciation. Cytoplasmic incompatibility (CI) is *Wolbachia's* weapon in these battles, where *Wolbachia*-infected males induce embryonic lethality in their uninfected offspring, giving their infected offspring a fitness advantage. Here, we report that older grandmothers yield sons that induce a higher rate of CI-lethality, a phenomenon we term the Paternal Grandmother Effect (PGE). We test if this increased penetrance of CI is due to increased *Wolbachia* titers or increased expression of the CI genes, *cifA* and *cifB*. Our results support a transgenerational effect of grandmother age on CI strength and have implications for both field and laboratory studies where precise control over strength of *w*Mel-induced CI will be valuable for dissecting the genetic and functional basis of CI.

Characterization of flagellin protein of *Campylobacter* species using monoclonal antibodies. ***Shreya Singh Hamal *and Fur Chi-Chen,*** *Tennessee State University, Nashville, Tennessee. Campylobacter* species are Gram-negative bacteria causing foodborne diarrheal disease worldwide. Flagella present in bacteria are not only important for motility but also consist of antigenic property. It is composed of two flagellin subunits primarily FlaA and secondary FlaB and are highly homologous. The objective of this study was to characterize the flagellin protein using two set of monoclonal antibodies (I and V) to form protein profiling. Ten strains of *Campylobacter* from three species namely *Campylobacter jejuni*, *Campylobacter coli* and *Campylobacter fetus* were cultured in *Campylobacter* blood-free agar (CCDA). Flagellin was extracted, separated by SDS-Polyacrylamide Gel Electrophoresis and tested with MAbs in Western blot for specific binding. The results showed that two distinct binding patterns between Groups I and V MAbs, band at size 65 KDa and minor band at size 45 kDa with all tested *C. jejuni* strains. Monoclonal antibodies therefore may be valuable in strain identification and immunological tests.

Physics and Astronomy
Section Chair: Mary Kidd

What's new for the SDSS standard star network? ***J. Allyn Smith, Douglas L. Tucker, and Sahar S. Allam,*** *Austin Peay State University, Clarksville, Tennessee (JAS), and Fermi National Accelerator Lab, Batavia, Illinois (DLT, SSA).* The Sloan Digital Sky Survey (SDSS) started observations in 1998. Part of the survey calibration depended on a set of standard stars which were developed for the new filter set the survey used. As the original survey was a northern hemisphere project, the standard stars were mostly located in the northern hemisphere and along the celestial equator. In the intervening years we have expanded the system to included fainter and southern hemisphere stars. We present the new system along with publication plans.

The utilization of neural networks in solving for ionospheric fluid flow. ***Megan McCracken*,*** *Austin Peay State University, Clarksville, Tennessee.* Neural networks have been used to solve different types of large data related problems in many different fields. This project takes a novel approach to solving the Navier-Stokes Equations for turbulence by training a neural network using Bayesian Cluster and SOM neighbor weighting to map ionospheric velocity fields based on 3-dimensional inputs. Parameters used in this problem included the velocity, Reynold's number, Prandtl number, and temperature. In this project data was obtained from Johns-Hopkins University to train the neural network using MATLAB. The neural network was able to map the velocity fields within a 67% accuracy of the validation data used. Further studies will focus on higher accuracy and solving further non-linear differential equations using convolutional neural networks.

Neutron inelastic scattering on ^{134}Xe at E_n = 5 - 8 MeV. ***Mary Kidd, Werner Tornow, Sean Finch, FNU Krishichayan, Megha Bhike,*** *Tennessee Tech University, Cookeville, Tennessee (MK), TUNL/Duke University, Durham, North Carolina (WT, SF, FK, MB).* Neutrinoless double-beta decay ($0\nu\beta\beta$) studies are both the best way to determine the Majorana nature of the neutrino and determine its effective mass. The two main experiments searching for $0\nu\beta\beta$-decay of ^{136}Xe (Q value = 2457.8 keV) are Kamland-Zen and EXO-200. Though both experiments have enriched 136Xe targets, these targets still contain significant quantities of ^{134}Xe. Recently, a new nuclear level was discovered in 134Xe that decays to the ground state emitting a 2485.7 keV gamma ray. The γ-ray production cross section for this branch was found to be on the order of 10 mb for incident neutron energies of 2.5 – 4.5 MeV. Here, we have extended the investigation of this level to higher incident neutron energies, and further explore the potential neutron-induced backgrounds on both ^{134}Xe and ^{136}Xe for extended neutron energies. We will report our preliminary results for neutron inelastic scattering on ^{134}Xe in applications to $0\nu\beta\beta$ decay searches.

Science and Math Teaching
Section Chair: Weston Dulaney

MTeach: Pathway to a successful career in chemical education. ***Rachel Marlin* and Judith Iriarte-Gross,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* MTeach is an opportunity for Middle Tennessee State University STEM major students to go directly into the field of teaching while working towards a college degree. This is beneficial to the students for many reasons: to see if they would enjoy teaching, to create good standing and connections with local middle and high schools, and to experience the classroom atmosphere from the other side of the desk. In Rutherford County teaching is not a rare career for many people, however there is a noticeable shortage in certified STEM teachers in middle and high school. In this presentation, I will discuss my experience as an MTeach chemistry major and how this program is helping me move forward in my career as a high school chemistry teacher.

Enhancing scientific literacy with NOS cards. ***Velta Napoleon-Fanis,*** *Middle Tennessee State University, Murfreesboro, Tennessee.* A primary focus of many science education reform efforts is to increase scientific literacy among K-16 students through the use of explicit, reflective instruction about the nature of science (NOS). In an exploratory, qualitative study conducted in a Life Science for Elementary Teachers course, NOS cards were used with pre-service teachers (PSTs) to facilitate productive discourse and scientific reasoning on topics that highlighted specific aspects

of NOS. Findings indicated an increase in positive attitudes towards science, the development of communication skills, and most importantly, an increase in the PSTs' scientific reasoning ability. Based on these findings, one may conclude that using NOS cards requires less complex instructional planning and allowed PSTs to emulate the desired goal of scientific literacy.

Esterification and molecular modeling of cinnamic acid esters. ***Anuradha Liyana Pathiranage, Leah J. Martin, Macy Osborne*, and Kirsten Meaker****, *Austin Peay State University, Clarksville, Tennessee (ALP, MO, KM) and Columbia State Community College, Columbia, Tennessee (LJM).* Fisher esterification is a common topic covered in many second semester undergraduate organic chemistry courses. In this research project several esters were synthesized via Fisher esterification of *trans*-cinnamic acid and various alcohols. The esters were purified using column chromatography and the products were characterized using Nuclear Magnetic Resonance (NMR) spectroscopy. This laboratory project was successfully carried out with second semester organic chemistry laboratory students. During last few years, cinnamic acid derivatives have been identified as interesting compounds with various medicinal properties. In the present study, molecular modeling of several cinnamic acid esters were carried out as potential anticancer agents. Molecular modeling will enable students to visualize binding interactions of cinnamic acid esters with target protein active sites.

Of ontogeny and phylogeny in the new science education paradigm. ***Philip C. Short,*** *Austin Peay State University, Clarksville, Tennessee.* The lack of qualified science teacher candidates has become increasingly severe in recent years. A paucity of competent K-12 science teachers often translates into fewer, well-prepared young people pursuing college science degrees. In this study, a grant provided stipends for undergraduate science majors to explore teaching careers through engaged, inquiry activities with school children of varied age groups. Pedagogical training for the new 3-D science education standards was provided. Perceptions of teaching science, teaching self-efficacy, and interest in science teaching careers were measured before and after completion of the program. Surprisingly, scores on both Science Teaching Outcome Expectancy and Personal Science Teaching Efficacy were lower in post-tests. During the metaphorical ontogeny of 3-D standards implementation, it appears that many potential teacher candidates, even those grounded in the sciences, revert back to earlier teaching models in the pedagogical phylogeny. Obstacles and inconsistencies in science educator preparation are discussed.

Preparing the table for 10 billion: Thinking globally and teaching locally about entomophagy. ***Donald L. Sudbrink Jr. and Amy M. Wright,*** *Austin Peay State University, Clarksville, Tennessee.* World population is forecast to approach ten billion by 2050, and food and feed protein production will need to be increased by more than half of current levels to meet demand, while arable land and fresh water resources will remain limited. With more than 29% of the world's population including insect proteins in their diet, many scientists and agriculturalists propose that insects can augment traditional livestock production to help meet these needs, but some groundwork must be laid in order to widely incorporate them into local food and feed systems. Cultural perceptions of insects in the West need to be reconceived. One approach to this re-conception is to incorporate entomophagy into existing sustainable agricultural education programs at a local level. At APSU, efforts are underway to engage and educate university and high school students and community members about entomophagy in courses, labs and community outreach for local hunger relief organizations.

We need not image what we can otherwise detect. ***Marcia M. Schilling***, *Austin Peay State University, Clarksville, Tennessee.* Proteomics has been confined to major research institutions due to the costly instruments associated with selection of proteins of interest and their identification using mass spectrometry. Unfortunately, this puts students at smaller universities at a disadvantage for being strong candidates in the field of proteomics for graduate study. In an effort to develop meaningful experiences in proteomics for undergraduate students, a plate reader was used to detect distinctions in colocalized fluorescent tagged proteins in lieu of using an expensive imager. Results demonstrated distinct amounts of colocalized proteins could be found using fluorescent dye ratios. The implications of this work provide an option for early undergraduate experiences in proteomics that can be offered to broader audience.

Using thinking routines and graphic organizers to support learning on a study abroad course. ***Darlene Panvini,*** *Belmont University, Nashville, Tennessee.* The structure of short-term study abroad courses pose pedagogical challenges for faculty who need to cover a course in a few weeks. Challenges include: lack of pedagogical resources and research; the need to intentionally intervene to structure learning so students have time to process, connect, and reflect to promote deeper thinking; little time for preparation or content front-loading; and finding balance between class-based instruction and experiential activities. Thinking routines and graphic organizers were used to address these challenges during a short-term course in Costa Rica. These tools fostered deep thinking through intentional writing by: sharpening student focus, connecting experiences with concepts, encouraging thinking and learning, promoting student reflection, and elucidating student concerns. Students stayed attentive to the learning aspects of the trip and student and faculty workloads were manageable. These tools can be a helpful resource for faculty teaching abroad, in internships, field trips, and laboratory activities.

Using stop-gap animation and storytelling to enhance student understanding in biology classes. ***Matthew J. Heard,*** *Belmont University, Nashville, Tennessee.* Purpose: There is growing recognition that using art and creative storytelling approaches can enhance STEM teaching practices. Objectives: In this presentation, I discuss how I used stop-gap animated videos and storytelling to help students in an upper-level biology class increase understand of biological concepts. In addition, I discuss how this approach can be translated into other classrooms and talk about the tools I used to help them complete these projects and assess their learning. Results: Using this approach, I had two important outcomes. First, all students stated explicitly in their evaluations that this activity improved their understanding of how to communicate science. In addition, all students expressed positive feelings about how this activity enhanced their learning in the class. Conclusion: My work and findings compliment an existing body of literature that suggests that students can improve their understanding, learning, and enjoyment in the classroom when creative assignments are incorporated.

Zoology

Section Chair: Danny L. Bryan

Characterization of solitary feeding in Eastern Woodrats (*Neotoma floridana* illinoensis) in Western Tennessee. ***Jessica Davin* and Michael L. Kennedy,*** *The University of Memphis, Memphis, Tennessee.* Feeding characteristics of the eastern woodrat (*Neotoma floridana illinoensis*) were investigated at the Edward J. Meeman Biological Station located approximately 17 km north of Memphis, Shelby County, Tennessee. Infra-red triggered cameras, placed over bait stations at multiple sites, were used to monitor activity. The prediction that the eastern woodrats are solitary feeders was tested. Results revealed that their behavior is antagonistic and that they are solitary in foraging for food.

A comparison of biodiversity measures of small mammals at arboreal and ground levels in edge habitat of eastern deciduous forest in western Tennessee. ***Sarah E. Swing* and Michael L. Kennedy***, *The University of Memphis, Memphis, Tennessee.* Biodiversity measures (species richness, species evenness, species abundance distribution, and biodiversity) of small mammals were investigated in edge habitat in eastern deciduous forest. Assessments were in forest-field edge habitats (shrub layer = arboreal; forest floor = ground level) at the Edward J. Meeman Biological Station located in Shelby County, Tennessee. The prediction that there was no difference in habitat utilization by small mammals in arboreal and ground-level habitats was examined utilizing live-trapping techniques. Results, based on 3,000 trap nights (trap night = 1 trap set for 1 night), 57 captures at the arboreal level, and 91 captures at the ground level, indicated that only species abundance distributions varied significantly between the two habitats. The white footed deermouse (*Peromyscus leucopus*) and the cotton deermouse (*Peromyscus gossypinus*) were the most common species captured. Such results add to our understanding of habitat use by small mammals in eastern deciduous forest.

Embryo development and global change: how do reptile embryos respond to ecologically relevant thermal stress? ***Joshua M. Hall* and Daniel A. Warner,*** *Auburn University, Auburn, Alabama.* Two components of global change, climate change and urbanization, contribute to increased ambient temperatures that cause heat stress or mortality in animals. Many animals can respond to harmful temperatures behaviorally; however, embryos of ectotherms which develop inside eggs in the ground and receive little or no parental care cannot respond this way. This early life stage is more vulnerable to harmful temperatures, yet, the effects of ecologically relevant thermal stress on these embryos has received little attention. We measured ground temperatures in an urban landscape where lizards (*Anolis sagrei* and *Anolis cristatellus*) nest and exposed eggs to extreme nest temperatures in the lab. We determined the critical thermal maximum for embryos of each species and assessed how thermal tolerance might change through development. Our results show that the thermal tolerance of reptile embryos can differ widely among closely related species, and thermal tolerance can change through development.

Gastrointestinal parasites of wild mammals in the Cumberland Gap Area of Tennessee. ***L. Angelica Solano*, Linnea Hansen*, Vina Faulkner, and Barbara C. Shock***, *Lincoln Memorial University, Harrogate, Tennessee.* The purpose of this research project was to determine parasites of wildlife in the Cumberland Gap area. The objective was to identify parasites present in mammal scat via fecal float in order to determine sylvatic parasite diversity. Three 30×50m plots of forest edge on the campus of Lincoln Memorial University were visited five times each during the study. Wildlife scat samples were collected and brought to the LMU laboratory for fecal float analysis. The collection of scat samples occurred from August 2018 to October 2018, and 25 scats from different wildlife species were obtained. Wildlife species were identified via scat morphology. Photos were taken of each parasite egg or larvae, and after consultation with veterinary parasitologists, were assigned to appropriate genera. These data are important to understand the baseline of parasite diversity in Appalachia and also because many of these parasites are potential health risks for humans and domestic animals.

Impacts of prescribed fire and forest thinning on tick populations and prevalence of tick-borne diseases in a southeastern mixed pine forest. ***Brent C. Newman*, William B. Sutton, Bharat Pokharel, Abelardo Moncayo, and Thomas Moore,*** *Tennessee State University, Nashville, Tennessee (BCN, WBS, BP), and Tennessee Department of Health, Vector Borne Diseases Program, Nashville, Tennessee (AM,*

TM). Landscape disturbance in the form of forest management can greatly alter habitat and climatic conditions causing shifts in host community composition as well as zoonotic disease pathways. However, the extent that tick populations and the prevalence of tick-borne diseases are impacted by forest management in the southeastern United States remains poorly understood. From June to August 2016 and 2017, we evaluated the effects of prescribed fire and forest thinning on tick species diversity and abundance as well as tick-borne disease prevalence at 18 management stands within the William B. Bankhead National Forest, Alabama, USA. Our results suggest heavy thinning may lead to a significant increase in tick populations while both heavy and light thinning coupled with prescribed fire application may significantly decrease tick populations. *Borrelia lonestari* was detected from collected ticks (n= 20, 1.2%); however, forest management technique did not impact disease prevalence. Our data indicate that forest management may be an effective option for managing tick populations in the southeastern United States which may decrease opportunity for tick-borne disease transmission.

Rickettsia proliferation in fleas and ticks on small mammals by the detection of ompA and gltA proteins. ***Rebecca A. Butler*, Rebecca Trout Fryxell, Allan E. Houston, Emerson K. Bowers, David Paulsen, Lewis B. Coons, and Michael L. Kennedy***, *University of Memphis, Memphis, Tennessee (RAB, EKB, LBC, MLK), University of Tennessee, Knoxville (RTF, DP), Department of Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville (AEH)*. Vectors transmit some of the most sever pathogens to humans and animals alike. We assessed small mammals for fleas and ticks in hardwood forest, pine forest, and field habitats at the Hobart Ames Plantation located in Fayette and Hardeman counties, Tennessee. Sherman live traps baited with rolled oats were utilized to capture all rodents. Parasites on rodents were assessed to determine if the presence of rickettsial ompA and gltA proteins were associated with host natural history. Total genomic DNA (deoxyribonucleic acid) was extracted from ectoparasites, and PCR (polymerase chain reaction) was used to screen for *Rickettsia*. A GLM (general linear model) was constructed to determine if there was a relationship between rodent traits, habitat types, and *Rickettsia* prevalence in fleas and ticks on rodents. No significant relationship was revealed for host traits, habitat type, and *Rickettsia* positive ectoparasites at the 0.05 alpha level.

Creating a protocol for tardigrades. ***Safaa Abid****, *Lincoln Memorial University, Harrogate, Tennessee*. Holding high interest in society, microscopic organisms known as tardigrades have the ability to survive in extreme environments when they enter a state of hibernation called cryptobiosis. Tardigrades can be collected from moss, lichen, and leaf litter; however, microscopy is needed to locate and identify these organisms due to their small size. The purpose of this project is to develop and create a protocol for the fixation of tardigrades. Adapting protocol for marine invertebrates is necessary in order to optimize and elucidate proper procedure for chemical fixation and drying for either paraffin wax or whole mounting for scanning electron microscopy. After samples were collected, there were various methods used. After performing these methods, they were reflected upon and the best procedure was identified.

One Health biosurveillance for mosquitoes as potential disease vectors atop the Cumberland Plateau of southern Tennessee. ***David Bruce Conn, Denise Andriot Conn, and Viktória Čabanová,*** *Harvard University Museum of Comparative Zoology, Cambridge Massachusetts (DBC), Berry College One Health Center, Mount Berry, Georgia (DBC), NASCENT, Monteagle, Tennessee (DBC, DAC), and Slovak Academy of Sciences Institute of Parasitology, Košice, Slovakia (VČ)*. A new biomonitoring program for disease vectors surveyed mosquitoes between September 2017 and September 2018 at diverse sites in Monteagle, Tennessee using CDC and BG-Sentinel traps and hand-held vials. Twenty-four species were identified (% of total for those over 5%): *Aedes albopictus* (9.2%), *Aedes canadensis, Aedes hendersoni* (11.8%), *Aedes japonicus, Aedes sticticus, Aedes thibaulti, Aedes tormentor, Aedes triseriatus* (7.2%), *Aedes trivittatus* (5.9%), *Aedes vexans, Anopheles crucians* complex, *Anopheles punctipennis* (12.4%), *Anopheles quadrimaculatus* s.l., *Coquillettidia perturbans, Culex erraticus* (22.9%), *Culex nigripalpus, Culex peccator, Culex pipiens/Culex quinquefasciatus* complex, *Culex restuans, Culex territans, Psorophora ferox, Psorophora horrida, Toxorhynchites rutilus, Uranotaenia sapphirina*. Most represent new distribution records, including alien invasive species *Ae. albopictus* and *Ae. japonicus*. Collectively they include vectors of numerous pathogens (e.g., West Nile, Dengue, Zika, Chikungunya, Yellow Fever viruses; *Plasmodium, Dirofilaria*) potentially infecting humans, domestic animals, and wildlife. Future programs should consider the potential for mosquito-borne disease transmission on the plateau.