

## Abstracts of Papers Presented at the 2017 Collegiate Meetings

### Western Region

Christian Brothers University

Memphis, Tennessee

1 April 2017

### Oral Presentations

#### Organismal Biology

Accumulation of heavy metals by chironomids in the Wolf River, Memphis, Tennessee. **Alex Wolf\*** and **Lynda Miller**, *Memphis University School, Memphis, Tennessee (AW)* and *Christian Brothers University, Memphis, Tennessee (LM)*. Chironomid larvae are aquatic macroinvertebrates which are filter feeders and inhabit the sediment. They are known to accumulate metals and are therefore commonly used in studies of heavy metal pollution. We examined three sites of the lower Wolf River in southwest Tennessee. Invertebrates were collected at each site and were identified to family. Chironomids were analyzed using atomic absorption spectroscopy to determine the concentration of cadmium, lead, copper, and chromium present. Metal values for lead, chromium, copper and cadmium were below the critical body burden threshold for *Chironomus* sp. at each site. The site with the highest metal concentrations was below the Greenline Bridge where construction was occurring.

Effects of *Microstegium vimineum* competitive interactions on focal plant growth and local species diversity. **Jacob Mann\*** and **James E. Moore**, *Christian Brothers University, Memphis, Tennessee*. We examined the impact of the invasive *Microstegium vimineum* on two native species *Polygonum virginianum* and *Boehmeria cylindrica* by measuring growth parameters in the presence or absence of *Microstegium*. Growth parameters were measured over four growing seasons (2012-2015). During the 2016 growing season no removal occurred, and all plants present in each plot were identified. Two-way ANOVAS were used to analyze the growth parameters to determine differences between removal and non-removal of *Microstegium*. We also determined if *Microstegium* positively or negatively affected growth. Shannon-Weiner Diversity was calculated to determine if long-term removal of *Microstegium* influenced community composition. *Polygonum* produced significantly more shoot height than *Boehmeria*, while *Boehmeria* produced signifi-

cantly more leaves than *Polygonum*. Both facilitation and competition occurred across sites. Diversity analyses indicated no significant difference of diversity between treatments. Our results suggest that response to *Microstegium* by increased growth in height may best reduce competition.

An investigation of germination and competitive ability between an invasive wetland plant species (*Lythrum salicaria* L.) and its native congener (*Lythrum alatum* Pursch). **Richard Grambergs\*** and **James E. Moore**, *Christian Brothers University, Memphis, Tennessee*. *Lythrum salicaria* L. is an invasive, obligate wetland plant which is recognized as a highly disruptive species in North America. We designed a series of experiments in order to investigate *L. salicaria*'s interactions with a native congener, *Lythrum alatum* Pursch. We tested the hypotheses that *L. salicaria* displays a competitive advantage over *L. alatum* due to its aggressive growth strategy, high germination rate, and use of allelopathy. We found that *L. salicaria* accumulated significantly more root biomass than *L. alatum* when grown together under greenhouse conditions. *L. salicaria* also germinated faster in both petri dishes and germination trays, and germinated 2.36 times more seeds than *L. alatum*. Additionally, we observed an inverse relationship between increasing cold stratification time and germination rate for both species. Our results suggest that *L. salicaria* possesses a clear competitive advantage over *L. alatum*.

Land cover change in South America and the potential impact on *Trypanosoma cruzi*. **Katharine V. Goebel\*** and **Sarah Boyle**, *Rhodes College, Memphis, Tennessee*. *Trypanosoma cruzi* is the protozoan causing the potentially fatal Chagas disease, also known as American trypanosomiasis. The vector is able to infect a range of mammal species, including humans. The infection can be modulated by habitat fragmentation and biodiversity loss, indicating the importance in studying land cover change. Through a literature review, the geographic distribution of *T. cruzi* in

marsupials, rodents, and non-human primates in South America, principally Brazil, was determined. Changes in land cover from 2005 to 2009 were identified, mapped, and then compared to the geographic distribution of *T. cruzi*. It was found that *T. cruzi* was primarily located in areas in which no land cover change occurred, suggesting maintenance of the hosts' habitats. The areas surrounding sites of *T. cruzi* occurrence which did undergo land cover change experienced the greatest change between shrubland to a mosaic of vegetation and cropland.

Morphometric variation in two species of ambystomatid salamanders across a geographic range. **Megan Mosier\* and Lynda Miller**, Christian Brothers University, Memphis, Tennessee. Populations of two species of ambystomatid salamanders were compared to determine if any variation exists as a result of a vicariant event. *Ambystoma texanum* and *A. opacum* populations from Arkansas and Tennessee were studied. These populations are separated by the Mississippi River and therefore may have developed differences over time. Front limb, hind limb, and snout-vent length were measured for each species. Populations on the west side of the river were compared to populations of conspecifics on the east side of the river. *Ambystoma opacum* was significantly larger in both front limb and hind limb length in Tennessee than in Arkansas. *Ambystoma texanum* was significantly larger in front limb and snout to vent length in Arkansas than in Tennessee. Though these two regions were originally chosen because they are separated by the Mississippi River, differences in morphometrics may be influenced by other factors, such as difference in habitat, as well.

A novel technique for assessing biomarkers of stress in snakes. **Kyle Fiornelli\*, Emily Lichtenberger, and Beth Roberts**, Christian Brothers University, Memphis, Tennessee (KF), Rhodes College, Memphis, Tennessee (EL), Research & Conservation Department, Memphis Zoo, Memphis, Tennessee (BR). The Memphis Zoo maintains a colony of bullsnakes (*Pituophis cateniss*) as a model species to better understand the endangered Louisiana pinesnake (*Pituophis ruthveni*). In early 2016, improvements were made to bullsnake housing through a grant from the Institute for Museum and Library Services. We evaluated the impacts of these improvements on bullsnake physiology using an unconventional approach. Our objectives were to 1) determine if snake skin sheds can be used for non-invasive hormone monitoring, and 2) identify changes in fecal and skin corticosterone concentrations associated with the housing improvements. Corticosterone was measured using an enzyme-linked immunoassay. We found that skin corticosterone was deposited evenly throughout the shed and decreased ( $p = 0.0027$ ) 40% after the renovation. Skin and fecal corticosterone concentrations were negatively correlated ( $r = -0.326$ ,  $p = 0.234$ ). Our results suggest that snake skin sheds can provide an indication of chronic stress, but further research is needed to validate this finding.

## Health and Medical Science

Amelioration of high glucose induced apoptosis on retinal explants with adipose-derived stem cell conditioned media. **Damian Kaminski\* and Ramesh Periasamy**, Christian Brothers University, Memphis, Tennessee (DK), University of Tennessee Hamilton Eye Institute, Memphis, Tennessee (RP). Abstract not published on request of researchers.

Asialo, triantennary oligosaccharide (NA3 glycan) and its binding partner, galectin-3, as a therapeutic drug for age related macular degeneration (AMD). **Ellen Garner\* and Monica M. Jablonski**, Christian Brothers University, Memphis, Tennessee (EG), University of Tennessee Health Science Center, Memphis, Tennessee (EG, MMJ). NA3 is a glycan that promotes proper folding of outer segment membranes and maintains protein expression patterns of photoreceptors and Müller cells in the absence of retinal pigment epithelium support. Herein, we evaluated the binding location of NA3 within the retina via double-labeling immunohistochemistry and we investigated the gene responsible for modulating the expression of the likely receptor of NA3, galectin-3. Results revealed that NA3 localizes to Müller cell end-feet in the ganglion cell layer and in the outer plexiform layer of both retinas of RCS rats, as well as in severe and mild AMD human retinas. Using simple and composite interval mapping, we determined that *Lgals3* controls its own expression. Knowing how NA3 works in the retina can move us forward into making this potential drug an effective treatment for atrophic AMD patients. Supported by: HEI Fellowship (EG).

A case study using principles of applied behavior analysis with a child diagnosed with a developmental delay. **Jessica Ruff\* and Wendy Ashcroft**, Christian Brothers University, Memphis, Tennessee. This study explored the effectiveness of Applied Behavioral Analysis (ABA) principles with a 4-year-old female diagnosed with a developmental delay. The child was observed in a classroom setting with 14 children (3-5 years) and the intervention program was implemented three days a week for three months. Observations were approved by the child's parents and the childcare facility. The child's behavior was observed during two daily activities, circle time and free time, where the target behaviors were increased peer-to-peer interactions and sitting independently in place, respectively. Once baseline levels were established, a personal intervention was designed to increase each target behavior. To assess the effectiveness of the intervention, the number of peer-to-peer interactions were then converted into rate percentages for pre and post intervention comparisons. The results demonstrated a 27% increase in the child's peer-to-peer interactions during free time and a 90% increase in target behavior during circle time.

Characterization of a recent Zika isolate. **Nirali S. Patel\* and Hunsni Elbahesh**, Christian Brothers University, Memphis, Tennessee (NSP) and Department of Microbiology, Immu-

nology, and Biochemistry, University of Tennessee Health Science Center, Memphis, Tennessee (HE). Abstract not published on request of researchers.

Comparison of different primers to determine the most effective method of RNA amplification of RSV. **Jonah Rendon\***, **Alex Ryder**, **Brett Clark**, and **Diego Hijano**. Christian Brothers University, Memphis, Tennessee (JR), Methodist Lebonheur Hospital Research Department (AR, BC, DH), Memphis, Tennessee. Abstract not published on request of researchers.

Expression of ryanodine receptor type 2 full length cDNA cloned from *Rattus norvegicus* cerebral artery myocytes. **Venkatasushma Kalava\***, **Guruprasad Kuntamallappanavar**, **Jianxi Liu**, and **Alex Dopico**. Christian Brothers University, Memphis, Tennessee (VK), University of Tennessee Health Science Center, Memphis, Tennessee (JL, GK, AD). Ryanodine receptors (RyRs) constitute a family of  $Ca^{2+}$  release channels primarily found in the sarcoplasmic reticulum that participate in many physiological processes (e.g., regulation of smooth muscle tone, cardiac and skeletal muscle contractility, neurotransmission, etc.) The cDNA encoding for the RyR isoform 2 (RyR2) was previously cloned and sequenced from *Rattus norvegicus* cerebral artery myocytes. In this study, we used immunohistochemistry, Western blotting and surface biotinylation to evaluate the intracellular and cell membrane expression of RyR2 protein following transfection of Human Embryonic Kidney (HEK) cells with such cDNA RyR2. Data demonstrate that RyR2 cloned from cerebral artery myocytes is highly expressed in both plasma and internal cell membranes. Functional characterization of this recombinant RyR2 using electrophysiological means is underway. Support: HL104631; R37AA11560 (AMD).

Management of diabetic tractional retinopathy without the use of vitrectomy. **Heer Patel\*** and **Michael Hood**. Christian Brothers University, Memphis, Tennessee (HP) and Charles Retina Institute, Memphis, Tennessee (MH). Diabetic retinopathy is a vascular retinal disease caused by uncontrolled levels of sugars. A further advanced form of the disease, proliferative diabetic retinopathy, can lead to the damage and excess growth of small blood vessels in the retina. This can then form a tractional retinal detachment. While there are no treatments for the detachment, there are ways to manage it. Panretinal photocoagulation lasers (PRP), intravitreal injections, and pars plana vitrectomies (PPV) are some of the common options for retinal detachment management. However, due to its invasive procedure, the benefits of the PPVs were compared to the lesser invasive procedures, PRPs and intravitreal injections. Out of 96 total procedures done, 75 were vitrectomies and 21 were either lasers or injections. In those that received the vitrectomy, 60% saw an improvement in vision and those that received either laser or injection, 80% saw an improvement.

Quantification of amyloid beta in Alzheimer's disease mouse models. **John B. Buttross, Jr.\***, **S. M. Neuner**, and **C. C. Kaczorowski**. Christian Brothers University, Memphis, Tennessee (JBB), The Jackson Laboratory, Bar Harbor, Maine (SMN, CCK). Amyloid beta peptide aggregates with other cellular waste products to form extracellular plaques, a classic neuropathological finding of Alzheimer's disease, in memory relevant regions of the brain. The present study was undertaken to quantify amyloid beta plaques across multiple Alzheimer's disease mouse model strains (N=40, Strains = 16) to identify genetic factors associated with variation in the severity of amyloid beta neuropathology. Forty mouse hemibrains were analyzed using ImageJ, at two age groups (six and fourteen months) in two regions: the cortex and hippocampus. Amyloid beta plaques significantly increased with age ( $A\beta 1-42$  rcortex = 0.82,  $p < 0.05$ ; rhippocampus = 0.54,  $p < 0.05$ , and  $A\beta 1-40$  rcortex = 0.74,  $p < 0.05$ ; rhippocampus = 0.56,  $p < 0.05$ ) and differed across strain ( $p < 0.05$ ). Furthermore, ImageJ quantification showed a strong relationship between amyloid beta ELISA data, which validated the use of amyloid beta levels as a quantitative trait for genetic mapping to help elicit novel Alzheimer's disease genes.

rAAV targeting GD3 synthase protects against MPTP-induced nigrostriatal destruction and Parkinsonian symptoms. **Nuti M. Desai\***, **David F. Delotterie**, and **Michael P. McDonald**. Christian Brothers University, Memphis, Tennessee (NMD), University of Tennessee Health Science Center, Memphis, Tennessee (DFD, MPM). Abstract not published on request of researchers.

Toxicity level of human keratinocytes for drug administration. **Prakruthi C. Phaniraj\***, **Purnendu K. Sharma**, and **S. Narasimha Murthy**. Christian Brothers University, Memphis, Tennessee (PCP), University of Mississippi, Oxford, Mississippi (SNM, PKS). The oral and parenteral administration of iron are poorly effective and associated with severe side effects. Therefore, there is a huge demand for alternate modes of administration of iron compounds for treating iron-deficiency conditions. Transdermal delivery offers a noninvasive and patient compliant method of administration of therapeutic agents. Ferrous bisglycinate and ferric pyrophosphate were chosen as potential sources of iron for transdermal delivery. To assess the appropriateness of these compounds for transdermal delivery, MTS assay was performed using human keratinocytes. The human keratinocytes were challenged with different concentrations of iron compounds and the viability of cells was determined. There was no significant drop in viable cell count up to 0.5  $\mu M$  Ferric pyrophosphate and up to 0.051  $\mu M$  in case of ferrous bisglycinate. These results suggest that the use of ferric pyrophosphate is a preferred iron source for transdermal delivery of iron.

Uncovering novel candidate genes that modulate the effects of prenatal ethanol exposure in BXD mouse strains. **Megan**

**L Huynh\***, **Kristin M. Hamre**, and **Jessica Baker**, *Christian Brothers University, Memphis, Tennessee (MLH)*, *University of Tennessee Health Science Center, Memphis, Tennessee (KMH, JB)*. Fetal alcohol spectrum disorders (FASD) cause developmental disabilities due to in utero exposure of alcohol. Previous research has shown a strong relationship between maternal and fetal genetics and the susceptibility of ethanol teratogenic effects following prenatal alcohol exposure. Specific quantitative trait loci (QTL) of murine chromosomes 10 and 19 were analyzed to identify candidate genes responsible for regulating apoptosis in the developing brain following alcohol exposure. Bioinformatic analyses narrowed down the list of candidate genes within the QTL that mediated ethanol-induced cell death. The list of genes in chromosome 10 narrowed from 88 (100%) genes to 5 (6%), candidate genes. The list of genes in chromosome 19 narrowed from 183 (100%) genes to 5 (3%) genes. Understanding the role of genetics in FASD will provide molecular pathways that can be used for treatment and be able to intervene earlier to promote better outcomes of FASD. Supported by UTHSC Neuroscience Institute.

Validation of the VIVID Stereopsis Vision Screening Program for the OPTO Application on the iPad Air Compared to Free Space Examination Techniques. **Keane R. Prosser\***, **Marc B. Taub**, **Jenny Rider** and **Kara L. Tison**. *Christian Brothers University, Memphis, Tennessee (KRP)*, *Southern College of Optometry, Memphis, Tennessee (MBT, JR)*, *Incarinate World Eye Institute, Memphis, Tennessee (KLT)*. The purpose of the present study was validation of an interactive vision screening application on the iPad to modernize and improve upon current free space vision screening techniques. The OPTOS app on the iPad measures: eye suppression, visual acuity, stereopsis, and phoria (horizontal and vertical). The testing objective was to determine if the iPad results were similar, or more accurate than the corresponding free space examination techniques. Participants (N=87, 4-12 years), were recruited during their eye exam, and randomized relative to testing sequence. Results showed iPad testing to be faster. Significant differences were found in the visual acuity and stereopsis testing, but not for horizontal or vertical phoria testing. The results of this study served as a proof of concept for using the iPad for vision testing but not as a replacement for traditional testing.

### Physics, Engineering, and Computer Science

Envirofish 2.0. **Wenting Zhu\***, *Christian Brothers University, Memphis, Tennessee*. The project was accomplished with the assistance of the U.S. Army Engineer Research and Development Center (ERDC) in cooperation with the U.S. Army Engineer District, Vicksburg (MVK) and the U.S. Army Engineer District, Memphis (MVM). The purpose of this project was to update software that can acquire information on rivers and streams that can be used to

calculate Habitat Units for specific floodplain habitats. Each habitat can provide different values for spawning and rearing fish. The updated software can be used in current operating systems and is friendlier to non-professional users. As a result, the software can be used in Windows 10 and results can be exported to Excel files.

IR signal transmission from underwater to above water. **Rudolph E. Brown\***, *Christian Brothers University, Memphis, Tennessee*. The primary way of communication with underwater devices is through use of SONAR. This is effective but limited. SONAR requires probes underwater at the receiving end in order to pick up the sound signal sent. This project is to create a device that can communicate from underwater through use of lasers. This would speed up communication as light travels much faster underwater than sound does. This would also eliminate the need to have probes under the water in order to receive the signal; this would eliminate a good deal of wire and space required to receive and deliver the signal. Lasers work very well through the water. The signals were easily picked up. Waterproofing the laser has proved difficult, but results are promising.

The LED Mirror. **John Frizzell\***, **Aaron Kellner\*** and **Sean Stocking\***, *Christian Brothers University, Memphis, Tennessee*. The purpose of this project is to demonstrate how pixel controlled LEDs can be turned into a "smart" mirror through the use of microcontrollers, edge detection software, and a picture capturing device. The objective of the mirror is to display the outlines of objects placed in front of a camera to a board of LEDs by taking a picture of the objects, sending it to edge detection software for image processing, and outputting the resulting image to the LED board through the use of pixel control. Possible uses for this project include advertisement, entertainment, and educational purposes.

Solar Controller. **Thanh N. Truong\***, *Christian Brothers University, Memphis, Tennessee*. The purpose of this project is to test the viability of a microprocessor controller solar panel setup. The objectives that were present includes designing and building a system that is powered by solar panels which are moved by servos that received commands from a microprocessor with a battery pack as a secondary source. The next goal after the prototype is complete is the testing and analysis of the efficiency of the said setup compared to a stationary solar panel setup. The data collected showed that the stationary generated a net gain in power whereas the microprocessor setup had a net loss. Drawing from the data, the current system can only self-sustain itself at an always ideal condition and will require more improvements.

Wireless Power Transfer. **Juan Avalos\*** and **Anh Kha Le\***, *Christian Brothers University, Memphis, Tennessee*. The objective is to implement a system that allows the transmission of energy from a power source to an electrical

load using the fundamentals of inductive coupling. The process includes the design of flat, multi-turn, loosely coupled coils and analyses of their behavior at different frequencies. The coils will be designed to improve range between the transmitting and receiving end, along with adequate efficiency. The topology used is due to the wide range of applications that can physically accommodate the coil itself. The system also required the design of efficient inverting and converting electronics. As a result, through the inductive coupling and the resonant induction applications, the system was able to operate efficiently with varying loads and distances.

### Poster Presentations

Analysis of close binary stars using the Dark Energy Camera. **Alison Crisp\***, **Christopher Johnson**, and **Robert Hynes**, *Christian Brothers University, Memphis, Tennessee, (AC)*, *Louisiana State University, Baton Rouge, Louisiana (CJ, RH)*. The purpose of the Galactic Bulge Survey is to catalog various X-ray emitting binary systems in the Bulge of the Milky Way Galaxy. We use the Dark Energy Camera to gather follow up optical data for objects previously observed with the Chandra X-Ray Observatory and Mosaic II CCD Imager. We also try to determine orbital and spin periods when possible. To do this, we use methods including aperture photometry, image reduction, and Lomb Scargle periodograms. In this study, we analyzed fifty-two objects. The objects sampled in this poster include CX81, CX279, CX853, and CX1194. Through this study, we found or confirmed that these objects are a dwarf nova in outburst, an eclipsing star, a likely eclipsing active star binary, and a confirmed active star.

Brain responses indicate that task difficulty and distractor salience create competition for attention. **Andrea Perez-Muñoz\***, **Patrick Woody\***, **James W. Rogers\***, **Jamonte D. Wilson\***, and **Jeffrey J. Sable**, *Christian Brothers University, Memphis, Tennessee*. Attention exists on a balance between directed focus (controlled attention) and still detecting other important information (automatic attention). Therefore, limited attentional capacity is automatically selective: a function of both the nature of distracting stimuli and an individual's focal task engagement. We engaged participants in easy and difficult attention tasks, while playing trains of distractor tones of same or varying pitches. We examined the auditory N1 component of the event-related brain potential (ERP)—a response elicited by stimuli even in the absence of overt attention—to each tone. Larger N1s generally indicate more attention. As predicted, N1 amplitudes were larger to “different” than to “same” trains, particularly during the easy task, and became larger to later tones in the trains. However, N1s were unexpectedly larger during the difficult task than the easy task. These findings suggest cognitive overload during the difficult task, making all tones highly distracting.

A graph theoretical analysis of the video game Portal. **Luke Wade\***, *Christian Brothers University, Memphis, Tennessee*. Teleportation is a concept that has been explored in literature, popular culture, and even quantum mechanics and cosmology. One intriguing example is the 2007 video game, *Portal*, which allows players to utilize teleportation in very unique ways in order to complete tasks and solve puzzles. In this research project, a simplified graph model of the game is developed and analyzed. Mechanics, obstacles, and goals common to the game are incorporated where appropriate. Questions of graph planarity, coloring, edge-counting and other topics are addressed. Other physical aspects pertinent to the model, such as momentum and line of sight, are then considered. The model is then used to find shortest paths for particular obstacle/objective/room-shape schemes with the aid of the Matlab programming software. Lastly, applications of this research to other areas of study are briefly examined.

Lichens of the Ghost River State Natural Area, Fayette County, Tennessee. **Hannah E. Schultz\***, **Thomas J. Sullivan**, and **Lynda R. Miller**, *Christian Brothers University, Memphis, Tennessee*. The Ghost River is a distinct section of the Wolf River which has widened into a swampy, slough-like area within a bottomland hardwood forest. This state natural area was established in 2003, and it encompasses approximately 898 ha. (2220 acres). It is located about 80 km east of Memphis in a rural, secluded site and is home to several rare and endangered species of plants and animals. Because of the undisturbed nature of this state natural area, we chose this site to establish baseline data of the lichen diversity found in southwest Tennessee. We have collected approximately 350 specimens and have found 32 different species comprising 25 genera and 13 families. Of the species identified, 47% are crustose, 44% are foliose, and 9% are fruticose. Many of these species are known to be pollution sensitive and are found there in great abundance.

New methods for studying behavior and spatial movement of captive species. **Erica C. Carcelén\***, **Sarah E. Ferguson**, **Sarah Boyle**, and **Miranda Rose**, *Rhodes College, Memphis, Tennessee*. Spatial data are often collected to understand movement and social networks of wild species; however, these data are typically not collected for captive species. Studying captive species is important to provide valuable information for species conservation. We suggest methods to study spatial interactions and behaviors. We highlight three case studies (meerkat, fishing cats, and elephant) at the Memphis Zoo as examples of how to map spatial data, record behaviors, and analyze these data using GIS. This highlights individual use of space in captive settings, interactions with other individuals, and spatial distribution of behaviors. These methods can be essential for zoos to understand the behavior of the individuals they house, which is important for daily animal care, selection of mating pairs, and management of captive social groups. On a broader scale, scientists could use this information to better

understand and predict how wild counterparts of these species may behave.

Protected areas of the southeastern region of the United States. **Erica C. Carcelén\* and Sarah Boyle, Rhodes College, Memphis, Tennessee.** The southeastern United States of America is important due to its biodiversity, especially amphibian biodiversity. National parks and protected areas have been established to conserve habitats; however, isolation from surrounding development and agricultural activity create edge effects and disrupt animal movement between habitats. Human support is vital to successful conservation, but people must be invested and educated about the environment and its threats. Parks and green spaces can encourage this investment by providing opportunities to interact with the environment. These maps aim to look at the national parks and protected areas in the southeastern regions of the United States of America, mapping the number of national parks and protected areas and their level of isolation. It also aims to evaluate the accessibility of these green spaces, especially for younger generations, which could be vital to generating interest in maintaining these spaces and promoting conservation.

#### Middle Region

Belmont University  
Nashville, Tennessee  
8 April 2017

#### Chemistry/Physics/Mathematics

Synthesis, characterization, and unusual solvation and luminescent properties of terbium amine complexes. **Libby Ligon\*, Justin Stace, Belmont University, Nashville, Tennessee.** Synthesized trivalent lanthanide ion-amine complexes exhibit unique properties and have potential for application in biological-mimic catalysis, photocatalysis, and photoluminescence. Here, three terbium-amine complexes have been synthesized by the reaction of terbium(III) nitrate with 13daprop (1,3-diaminopropane), 15dapent (1,5-diaminopentane), and phen (1,10-phenanthroline) in methanol. The off-white product of each reaction precipitates at  $-20^{\circ}\text{C}$  overnight and is captured *via* filtration. All three complexes form colloidal suspensions in water and acetonitrile. The colloidal suspensions strongly absorb ultraviolet radiation. The  $\text{Tb}(\text{phen})_2$  complex also exhibits very strong visible luminescence, and fluorescence lifetime data for  $\text{Tb}(\text{phen})_2$  reveals a relatively long-lasting luminescence ( $\sim 1.5$  ms). Results from elemental analysis leads to speculation that the  $\text{Tb}(\text{13daprop})$  and  $\text{Tb}(\text{15dapent})$  complexes are polymers. The photophysics of  $\text{Tb}(\text{phen})_2$  are discussed in detail.

Cavity ring-down spectroscopy of gas-phase ions prepared via electrospray ionization. **Bailey S. Rose\*, Libby L. Ligon\*, Thomas G. Spence. Belmont University, Nashville, Tennessee.**

Cavity ring-down spectroscopy is an ultrasensitive direct absorption technique that has been, for the most part, only applied to absorbers in the gas phase. Here, a cavity ring-down system has been built using a nitrogen pumped dye laser, and a decay signal has been acquired. An electrospray ionization (ESI) source will be used to produce gas-phase ions from the condensed phase for detection via cavity ring-down spectroscopy. With this technique, ions separated by traditional chromatographic techniques can be detected at significantly lower concentrations than by performing absorption spectroscopy on the condensed phase analyte.

The biexciton puzzle. **David K. Zhang\*, Daniel W. Kidd, and Kálmán Varga. Vanderbilt University, Nashville, Tennessee.** The Stochastic Variational Method (SVM) is used to show that the effective mass model correctly estimates the binding energies of excitons and trions, but fails to predict the experimental binding energy of the biexciton. Using high-accuracy variational calculations, it is demonstrated that the biexciton binding energy in transition metal dichalcogenides is smaller than the trion binding energy, contradicting experimental findings. It is also shown that an excited state of the biexciton is in very good agreement with experimental data. This excited state corresponds to an hole attached to a negative trion and may be a possible resolution of the discrepancy between theory and experiment.

Biotransformation of cycloastragenol and curcumin. **Howsi-kan Kugathasan\* and Glenroy Martin, Fisk University, Nashville, Tennessee.** Cancer and aging are two medical challenges that are faced in our society and research is being conducted to address them. Two natural products that have been considered for each of these respective ailments are curcumin and cycloastragenol. However, problems such as solubility and poor bioavailability render them difficult to pass through the bloodstream to reach their target sites. This investigation seeks to apply the principles of fungal biotransformation reactions to obtain transformed metabolites of curcumin and cycloastragenol with potentially enhanced biological activities. The chosen microbes for this project are *Beauveria bassiana*, *Aspergillus niger*, and *Rhizopus oryzae*, all of which have well-documented records of transforming a broad range of organic compounds. The methodology consists of three phases: 1) culturing and fermentation of fungi, 2) isolation and characterization of biotransformed metabolites, and 3) biological assays of biotransformed metabolites. A guiding theme in this project is adherence to the principles of green chemistry by minimizing toxic waste and utilizing milder reaction conditions.

A precision magnetic mapper for the UCNtau experiment. **Keegan Hoffman\* and Adam Holley, Tennessee Technological University, Cookeville, Tennessee.** The free neutron lifetime is a physical constant that is associated with a variety of experimental tests for new physics. The UCNtau collaboration has the ultimate goal of measuring the free neutron

lifetime to within 0.01%, or to an error of about 0.1 s. A trap composed of a bowl-shaped Halbach array wrapped by field coils is used to contain polarized, ultracold neutrons (UCN), which are allowed to decay inside the trap. The Halbach magnets, in conjunction with gravity, keep UCN from escaping while the field coils prevent the UCN from depolarizing. However, there will be a systematic error if UCN leave the trap for a reason other than decay. We have constructed a robotic arm to move a three-axis Hall probe through the volume of the trap with 1 mm precision to check for low-field regions. We will describe the design and control software for this magnetic mapping system.

### Bio I: Ecology/Zoology/Botany

Decomposition rates of *Acer saccharum* and *Lonicera maackii* in mixed litter bags. **Anna Anderson\* and Darlene Panvini**, Belmont University, Nashville, Tennessee. Invasion of exotic species can influence decomposition rates and nutrient cycling in a forest. Leaves of exotic species have been shown to decompose faster than native species. This study evaluated decomposition rates of litterbags containing native *Acer saccharum*, exotic *Lonicera maackii*, and both species (mixed species bags). Litterbags were weighed and placed throughout an urban deciduous forest in Nashville, Tennessee at sites that contained canopies of *A. saccharum*, *L. maackii*, or both species. Litterbags were collected over six months and reweighed to determine mass lost. The results show that all species types decomposed the fastest at the invasive, exotic site, and that the mixed species litter decomposed the fastest at each site in comparison to the native and exotic species individually. The implications of this research will add to the knowledge of changing forests and the effects of exotic species on nutrient cycling.

Examining the biodiversity in soil microbiota, arthropods and green roof flora on established and newly created green roofs. **Kelsey Saint Clair\*, Chris Barton, and A. Darlene Panvini**, Belmont University, Nashville Tennessee. Green roofs enhance urban diversity by creating green spaces in metropolitan settings. Little research has examined the relationship between soil microbiota, arthropods and plant diversity on green roofs. We compared diversity on two green roofs at different stages: established versus newly-created. We predicted the older green roof would have more species diversity. DNA barcoding was used to identify plants, pitfall traps and sweep nets were used to determine arthropod diversity, and Biolog EcoPlates™ were used to assess microbial functional diversity. The newly-created green roof exhibited more species of plants per area and more structural complexity, resulting in a greater diversity of arthropods. Bacteria diversity was greater on the established green roof. The intermediate disturbance hypothesis could explain the greater diversity on the new green roof. If we know how diversity changes over time, this research can

provide insight into how green roofs can be managed to enhance urban biodiversity.

Effects of acute stress on apomorphine-induced *Danio rerio*. **John Longenecker\* and Lori McGrew**, Belmont University, Nashville, Tennessee. Zebrafish (*Danio rerio*) are a well-established model for neuroscience research due to similarities in their central nervous system, including dopaminergic neurons and receptors. Dopamine is integral to the reward/pleasure system, and has been publicized as one reason for drug dependence. Contrary to this, research is also being done on the use of dopamine therapy during drug withdrawal. The purpose of this study is to determine if Apomorphine, a dopamine agonist, influences anxiety, and could ease the drug withdrawal process. The objectives of this study were to observe if inducement affects the duration and latency of time fish felt anxious, as well as the extent to which inducement impacts mobility. A pilot study was done to assess drug tolerance. Results of this study showed significant differences in latency ( $p=0.02$ ) and velocity ( $p<0.01$ ) with trending contrasts in cumulative duration. In conclusion, Apomorphine moderately decreased anxiety and significantly impacted velocity.

Effect of sodium chloride levels on anxiety in zebrafish (*Danio rerio*), **Austin DeMaagd\* and Lori McGrew**, Belmont University, Nashville, Tennessee. Studies indicate that electrolyte levels have clinical implications for health and wellness. In model organisms, electrolyte imbalance has been linked to problematic neurophysiology, specifically anxiety. With this evidence, the question asked is whether sodium chloride levels dictate anxiety levels of organisms. The zebrafish (*Danio rerio*) was used to evaluate this relationship, due to the fish's reactions to environmental factors, and its testability using a novel dive tank. Three groups were tested: a control group with standard conditions, a group exposed to 0.3 M sodium chloride for three days, and an identical group exposed for twenty-one days. A One-Way ANOVA test was performed on the data. The three day group experienced higher levels of anxiety compared to the control or twenty-one day groups. The benefits of this study could have clinical significance, specifically for diagnosis and treatment of anxiety and electrolyte imbalance. Also a greater understanding of zebrafish neurophysiology was achieved.

The effects of isoflurane on learning and spatial memory in *Danio rerio*. **Curtis Brown\* and Lori McGrew**, Belmont University, Nashville, Tennessee. Postoperative cognitive dysfunction is a medical condition characterized by an impairment in cognition following anesthesia and surgery. Typically affecting elderly patients, this complication may interfere with everyday functions and lead to further health complications. Zebrafish (*Danio rerio*) are commonly used as a model organism to study mechanisms of brain function and dysfunction, exhibiting similar neural physiology and pharmacological responses to that of humans. The objective

of this study was to evaluate the effects of general anesthesia, on short-term memory in zebrafish. Through operant conditioning, the fish were trained to discriminate between colors in a T-maze, and treated with isoflurane for varying exposure times to observe changes in spatial learning and short-term memory. Choice latency times and the number of correct choices were recorded. As exposure times increased from two minutes to four minutes, a trend of less correct choices and longer latency times followed, however these results were found to be insignificant.

Behavioral syndromes of *Elimia* snails in a predator-prey system. **Ryan Tapley\*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee. Behavioral syndromes are a set of correlated behaviors in response to multiple situations with conflicting solutions, causing an animal to respond sub-optimally to a situation. Predators have big effects on prey behavior. Prey face trade-offs safety from predators and potential gains from increased foraging. We hypothesized a conflict, in snails, between actively foraging under ideal conditions and restricting activity in presence of a predator. Snails were placed in cups a exposed to control water and water with crayfish kairomones. Snail movement was recorded in both types of water and compared to look for a syndrome. We were unable to detect a change in behavior due to predator cues. And while there was significant correlation between movements of a particular snails in both types of water, the low  $r^2$  value suggested only weak repeatability. Without a significant predator effect we would be unable to detect a conflict or a behavioral syndrome.

The effect of prey size on its antipredator behavior in a snail crayfish system. **Joanna Sorrell\*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee. Chemical cues are a key factor in the optimal foraging behavior of snails and their interactions with predators. The reaction of prey to predators, should depend on their individual risks and benefits. An individual's size may affect this balance, leading to different reactions to a predation threat. In this experiment we tested if snails of different sizes would therefore have different reactions and behavioral responses to chemical cues of their natural predators, the crayfish. Small and large snails were introduced to control water and water containing crayfish cues and their defensive behavior was observed. Large snails had no change in behavior between water treatments, however small snails showed a significant increase in antipredator behaviors. This could indicate a higher risk, or potentially lower rewards, for small snails foraging under risk of predation.

The reaction of native and exotic snails to the kairomones of a native predator. **Jasmine Conyers\*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee. Predator kairomones have a big influence on prey behavior. Kairomones may be specific to a certain predator. Past studies have shown that our native snail reacted differently to native and

exotic predators. In this experiment the antipredator responses of our native *Elimia laqueta* and exotic Nerite snail behaviors were compared in response to our native predator, *Orconectes dorelli*. A two way ANOVA revealed no difference in prey species in regards to the native predator, in activity or crawl out behavior. However since we failed to get a significant antipredator behavior in our native prey, as expected, we cannot draw definitive conclusions. However, the exotic Nerite snail species spent more time out of water, in all conditions, than the native *Elimia* species. Crawl out behavior is the expected response of *Elimia* to predator kairomones.

The response of naïve and experienced snails to a predator cue. **Shirley Kyere\*** and **John H. Niedzwiecki**, Belmont University, Nashville, Tennessee. Prey have the ability to receive and interpret information about their environment through chemosensory information. Prey detect predators through chemical cues called kairomones and these kairomones affect prey behavior. Since *Orconectes dorelli* crayfish and *Elimia laqueta* snails live in the same environment, our goal was to determine if snails habituate to the crayfish. To test this, snails were exposed for 3 and 6 days in a pre-treatment and were then divided equally into cups for predator or control treatments. We then compared the anti-predator reaction of snails to kairomones or controlled water, based on previous exposure. Although snails from both treatments were very active, there was no significant difference based on prior experience with or presence of kairomones in either anti-predator behavior or movement. We have no support for habituation, however without a significant anti-predator response no conclusions can be made.

Effects of precipitation changes on switchgrass physiology, roots and biomass. **Jaquantey Bowens\***, **Kenya Collins\***, **Sadiye Aras**, **Chih-Li Yu**, **Qi Deng**, and **Dafeng Hui**. Department of Biological Sciences, Tennessee State University, Nashville, Tennessee. Climate change and energy crisis are two important issues we are facing today. Bioenergy crops such as switchgrass can be used as sustainable energy resource as well as mitigating climate change. However, the interaction between switchgrass productivity and climate change such as precipitation change has not been well investigated. We conducted two precipitation experiments in Nashville, Tennessee to investigate switchgrass physiology, roots, and biomass under different precipitation intensities. One was conducted in an environmentally controlled greenhouse; the other was a field study. Both experiments used randomized complete block design with five precipitation levels including a control (ambient precipitation), +33%, +50% of ambient to simulate wet, and -33% and -50% of ambient to simulate drought treatments. Preliminary results from the greenhouse study indicated that no significant differences in plant physiology were observed before the precipitation treatment. In the growing season, the photosynthetic rates in the +33% and +50% treatments



were about  $19.5 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ , significantly higher than other three treatments. The lowest one was found in the -50% treatment ( $17.26 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ ). The biomass in the +50% treatment was the highest and the lowest was observed in the -50% treatment. This study indicates that although switchgrass is a drought tolerant grass, high precipitation stimulates switchgrass photosynthesis and growth. These findings are valuable for farmers to prepare and improve bioenergy crop production in future climate.

## Bio II: Cellular/Micro/Health Med. Sciences

Treatment effects of emetine on HCT-116 cells. **Kerry Sommers\***, Belmont University, Nashville, Tennessee. Emetine, a natural compound originating from ipecac roots, has been utilized as a chemotherapeutic agent due to its apoptosis-inducing effects. Emetine has been used primarily for the treatment of lung and blood borne cancers, however there is little research on emetine's effects on colon cancer. This study addresses the effect of emetine on the proliferation and death of HCT-116 colorectal cancer cells. The cells were treated with three different concentrations of emetine over three time points. After determining that emetine had the capacity to kill the colon cancer cells, fluorescent microscopy was used to determine the mode of cellular death. The results of the microscopy analysis revealed that emetine inhibited proliferation and induced apoptotic cell death in the HCT-116 cells.

Chemotaxis of *Caenorhabditis elegans* with *Bacillus thuringiensis* 4A4 in vegetative and sporulated growth stages. **Meghan McGath**, Belmont University, Nashville, Tennessee. A study performed by Angel Brothers at Belmont University looked at the attractant or repellent properties of vegetative *B. thuringiensis* 4A4 and fifth, sixth, and seventh day sporulated *B. thuringiensis* 4A4. The study observed what occurred to the *C. elegans* during the first and seventh hour of chemotaxis for the vegetative state and the first and twenty-fourth hour for the sporulated state. The goal of the current study is to find out what occurs to the *C. elegans* during the first, fourth, and tenth hours of a chemotaxis assay with vegetative *B. thuringiensis* 4A4 and the fourth, tenth, and twenty-fourth hours on the fifth, seventh, and ninth days for sporulated *B. thuringiensis* 4A4. Results point to the *C. elegans* being attracted to the vegetative *B. thuringiensis* 4A4 and not the control, water. Likewise, that are attracted during the beginning of chemotaxis for the sporulated *B. thuringiensis* 4A4. However, at the twenty fourth hour it was shown that the *C. elegans* began to chemotaxis towards the control, water. Findings indicate that *C. elegans* followed the predicted hypothesis of moving towards the *B. thuringiensis* 4A4.

Caffeine's effect on the chemotaxis of *C. elegans* after a short exposure time. **Madeline Johnson\* and Robert Grammer**, Belmont University, Nashville, Tennessee. *Caenorhabditis*

*elegans* is a nematode that is found worldwide. Its sequenced genome, short life span, transparent anatomy, and inexpensive cost make it efficient for experimental purposes. Widely consumed in foods and beverages, caffeine is a psychostimulant, meaning it temporarily induces improvements in both mental and physical functions. In this experiment, caffeine was used as the chemical stimulus to *C. elegans*. Recently, a study performed at Belmont University suggested that the concentration of caffeine that *C. elegans* are exposed to had an effect on the locomotion toward an attractant - with increased concentration of caffeine, stronger chemotaxis indexes (CI) were displayed. The purpose of this study was to determine if various concentrations of caffeine could affect the chemotaxis of *C. elegans* even after a short, three-minute exposure. This study concluded that the nematode shows an insignificant chemotaxis when treated with dosages of 1 mM, 10 mM, and 20 mM caffeine.

Expansion on the Nematode Scent Detection Test: Evaluating *C. elegans* Attraction to Non-Small Cell Lung Cancer. **Brian R. Song\* and Robert Grammer**, Belmont University, Nashville, Tennessee. *Caenorhabditis elegans* (*C. elegans*) have shown chemotaxis towards cancer. By applying this behavior clinically, a cancer screening system was devised and showed effectiveness for several cancers. Research shows that the nematode is also attracted to cervical cancer. It is not known whether the system was useful for lung cancer. This project's objective is to evaluate if *C. elegans* displays attraction to A549 cells (non-small cell lung cancer), when WI-38 (normal human lung fibroblast tissue) is the control. It has been observed that dilutions to the millionth and ten-millionth showed positive chemotaxis. Results showed chemotaxis regarding dilutions of conditioned A549 medium with fresh medium as the control, and negative chemotaxis with all dilutions of WI-38. With A549 as the positive and WI-38 as the negative control, a choice assay was performed. The attractant used was A549 and the control was WI-38. Results showed positive chemotaxis at the dilutions of used media.

Seeking Behaviors of Nicotine. **AJ Arnold\* and Robert Grammer**, Belmont University, Nashville Tennessee. Nicotine is one of the most heavily used addictive drugs in the United States. Nicotine travels to the brain and binds to receptors where the neurotransmitter acetylcholine would normally dock. *Caenorhabditis elegans* exhibit seeking behaviors parallel to mammals when exposed to nicotine. In this experiment, nicotine and *Escherichia coli* tested the seeking behaviors of *C. elegans*. In these experiments, *C. elegans* were placed onto a chemotaxis plate with *E. coli* on one end and nicotine on the other. The nicotine concentration was 3 mmol or 30 μmol. Prior to the chemotaxis assay, the nicotine was left on the plate over time to diffuse. Gradually, most of the *C. elegans* started crawling towards the nicotine and only a few to *E. coli*. Changing the concentration levels of the nicotine better explained the seeking behaviors of the

organism. There was statistical significance indicating that the *C. elegans* were attracted to the nicotine.

Disinhibition of *C. elegans* towards *Bacillus thuringiensis*. **Samantha Bush\***, **Robert Grammer**, Belmont University, Nashville, Tennessee. Alcohol has a wide variety of effects on physiology and behavior in many species. One of the most well recognized behavioral effects is disinhibition, where behaviors that are normally suppressed are displayed following intoxication. *Caenorhabditis elegans* are a model organism because of their ability to reproduce fast, they are easy to maintain, and have a similar genome to humans. In this experiment, *C. elegans* are washed with different dilutions of ethanol. The worms are then put on a chemotaxis plate to see if the ethanol will cause disinhibition of eating the bacteria *Bacillus thuringiensis*. The chemotaxis assay showed an increased attraction to the *Bacillus thuringiensis*.

The effects of dopamine on learning and certainty in zebrafish. **Stephan Morin\*** and **Lori McGrew**, Belmont University, Nashville, Tennessee. Literature has suggested that dopamine plays a crucial role in the development of memories and learning via the reinforcement method. Dopamine has been shown to respond to aversive stimuli, meaning dopamine influences aversion learning as well as reinforcement learning (Schmidt, R., G. Morris, E. H. Hagen, R. J. Sullivan, P. Hammerstein, and R. Kempter, 2009). In a study done just early this year it was shown that situations where animals learn to avoid negative stimuli is regulated by dopamine (Dani, John, PhD., 2016). In the present study, this effect was looked into to determine whether or extra dopamine could further increase the natural learning ability of Zebra fish. It was hypothesized that the increase in dopamine in the fish would lead to a greater learned response. To test this, the fish were all trained in the same T-maze under the same conditions. The fish were split into three groups – a control group – a pre dose group - a post group. The maze testing followed a basic reward punishment system. The results looked at after the final testing for each group included whether or not the fish took the right path on the T-maze; the total time spent to complete the maze; and the time each fish spent latent during their time on the T-maze. These figures can help determine whether the fish knew the right choice, and how certain the fish were in that decision (time latent compared to total time).

Caffeine's effect on chemotaxis of *C. elegans* at various stages of life. **Emily Shearon\*** and **Robert Grammer**, Belmont University, Nashville, Tennessee. No research currently exists that discusses *C. elegans*' ability to perform chemotaxis in the L1 life stage. This study aims to see how different concentrations of caffeine affect L1 worms' ability to chemotax when compared to worms at the L4 life stage. Caffeine is of significant interest in this study due to the amount known about effects it can have on motor skills in *C.*

*elegans* and because it is a staple in food products around the globe. Our data suggests that L4 worms treated with caffeine follow a similar trend to previous Belmont University research (Nunez & Grammer, 2015). Though it was expected that L1 worms would also follow this trend, the pattern observed was quite different. In the future, further replicates of the L1 experiments should be performed to determine if these results are due solely to L1 worms' inability to move as well their young adult counterparts.

pH indication of respiration and effects of different carbohydrates and *E. coli* on respiration rates in *Caenorhabditis elegans*. **Prisha S. Patel\*** and **Robert Grammer**, Belmont University, Nashville, Tennessee. Previously, researchers outlined procedures to detect respiration in *C. elegans* using spectrophotometry. They reported acidification based on absorbance and the effect of sodium azide. This study aimed to solidify the procedures involving spectrophotometry from the initial study and to investigate the effects of sugars and *E. coli* on respiration rate. It was hypothesized that each sugar and *E. coli* would have detectable respiration of *C. elegans*, but *E. coli* and glucose would generate the strongest effects. Instead of using spectrophotometry, pH probes were utilized to detect pH changes. Baseline experiments revealed minimal differences in respiration of worms treated and not treated with sodium azide. Even though the addition of 1.6 mM sugar produced minimal differences, *E. coli* generated a greater change in pH levels for the worms not treated with sodium azide. Future studies can explore the effects of other bacteria, lipids, or protein on respiration rates of *C. elegans*.

The effect of piracetam on *Danio rerio* with ethanol-induced memory impairment. **Mohamed Darwish\*** and **Lori McGrew**, Belmont University, Nashville, Tennessee. In this experiment, the neurotherapeutic effects of piracetam on memory were examined. Piracetam is a memory-enhancing nootropic drug that has been demonstrated to reverse induced memory impairment. Due to their similarities to humans, zebrafish are a popular model organism and were used in this study. Zebrafish were chronically exposed to ethanol and then treated with piracetam over a three-week duration to determine if memory impairment induced by the ethanol was alleviated by the piracetam. After the three-week duration, the fish were trained and tested using a T-maze with color cues and a reward and punishment system, and their choice latencies were analyzed. Results show untreated fish performed best in the maze, while fish only exposed to ethanol performed the worst. Statistical analysis showed no significance in the data, but the data did show trends that could be researched further with additional experimentation.

Examining the effects of anandamide intake on working memory in Zebrafish. **Sam Zacovic** and **Lori McGrew**, Belmont University, Nashville, Tennessee. The endocannabinoid system is active in a wide range of physiological processes such as sleep, hunger, memory, and stress.

Anandamide is a naturally occurring psychoactive cannabinoid that neurons release to inhibit the cortisol stress response. Anandamide interacts with CB1 and CB2 receptors, located in the central and peripheral nervous systems. CB1 receptors are present throughout the medial pallium in the amygdala and in the hippocampus. Both of these structures are thought to be involved in associative learning. Using zebrafish as a model organism, because of their extensive endocannabinoid system, the interaction of cannabinoid activation with working memory was examined. The fish executed a t-maze task with reward and punishment scenarios. The right arm of the maze contained a reward while the left arm of the tank would force the fish into a stressful situation (punishment). They were trained until they could consistently navigate to the right arm of the maze based on the reward or punishment they encountered during training. Once trained, the fish were submerged in anandamide solution to stimulate internal cannabinoid activity. It was hypothesized that a lower dose of anandamide would not have an effect on t-maze performance, but a high dose would exhibit inhibitory effects on their recently learned association.

#### Eastern Region

Pellissippi State Community College  
Knoxville, Tennessee  
21 April 2017

#### Oral Presentations

CRISPR: The future of genetically modified genes, a review of current literature. **Haley B. Davis\*** and **Saeed Rahmanian**, *Roane State Community College, Oak Ridge, Tennessee*. Imagine doctors creating a process that makes a human immune to all genetic diseases, picking specific traits of a person, or even growing a new crop completely unaffected by cold weather. Clustered Regularly Interspaced Short Palindromic Repeat, CRISPR, may be the key to unlock and enhance genes. CRISPR was first discovered in the observance of bacterial immune systems. The CRISPR sequence in the bacterial DNA allows the organism to replicate and store the virus's DNA, preparing for a future attack. Researchers have discovered how to replicate this process by using a protein (Cas-9) to clip DNA at a specific location and guide RNA to make sure the cut is precise. CRISPR could potentially cease all genetic diseases. With this process, researchers are now wondering if CRISPR could change the way that humans live. CRISPR is still in the testing phase but is showing promising results.

Evaluation of mitochondrial function in PARK2 knock out *C. elegans* exposed to the pesticide manzate. **Samantha Cole\***, **Rachel Mullins\***, **Sunny Kennedy\***, **Ashley Reynolds\***, **Erin Jennings\***, **Laura Kelly Vaughan**, and **Vanessa Fitsanaksis**. *King University, Bristol, Tennessee*. Parkinson's

disease (PD) is characterized by neurodegeneration of dopamine neurons in the brain which leads to loss of motor function and often decreased mitochondrial function. The *parkin* gene (*PARK2*) is associated with a form of PD; however, not all people with this mutation develop PD. It is hypothesized that exposure to environmental triggers must also occur. One of these triggers may be manzate (MZ), a commercially-used pesticide that causes neurodegeneration in *C. elegans*. To test this hypothesis, we used a strain of *C. elegans* that has a *PARK2* deletion (VC1024). *PARK2* helps with ubiquitination, which tags damaged cellular components, including mitochondria, for degradation. We treated VC1024 worms with MZ and then assessed mitochondrial function. Our results suggest that VC1024 worms may be more susceptible to MZ exposure than wild-type. While more research is required, this may mean that people with a *parkin* mutation may be more vulnerable to pesticide exposure.

Evaluation of optimal dye combinations in gel electrophoresis separation for general biology lab courses. **Nathan Falconnier\***, **Lily Turaski\***, **Tara Walker\***, and **Patricia Zingg**. *Pellissippi State Community College, Knoxville, Tennessee*. Freshman biology courses at Pellissippi State Community College (PSCC) use gel electrophoresis to demonstrate DNA fingerprinting. Kits with DNA cut by restriction enzymes are expensive, and gels must be stained by ethidium bromide, a known carcinogen. Therefore, a substitute was sought that was safer, cheaper, and more easily visualized. Available dyes were evaluated to find their charge to weight ratios to determine the best candidates for this application. The chosen dyes were then tested independently and in combination for gel electrophoresis.

Generation and analysis of mitochondrial function in a novel strain of *C. elegans* selected for resistance to the pesticide Touchdown. **Sunny Kennedy\***, **Erin Jennings\***, **Ashley Reynolds\***, **Rachel Mullins\***, **Samantha Cole\***, **Vanessa Fitsanaksis**, and **Laura Kelly Vaughan**, *King University, Bristol, Tennessee*. Pesticides are currently studied as a contributor to neurodegenerative disorders, including Parkinson's disease (PD). Touchdown (TD) is a commercial pesticide that has been associated with neurodegeneration in *C. elegans*, similar to what occurs in PD, and has been linked to mitochondrial dysfunction. Initially, wild-type worms were treated with lethal concentrations of TD that were anticipated to kill eighty percent (LC80) of the worms. Treatment was continued for five generations, selecting for worms with TD resistance. These LC80 worms were then treated with TD to determine if this protection involved reduced mitochondrial inhibition. Mitochondrial function was assessed by measuring the uptake of the fluorescent dye TMRE. When the LC80 worms are compared to wild-type controls, we anticipate that these LC80 worms should be less vulnerable to TD, as assessed by increased TMRE uptake. The goal of future studies is to sequence candidate genes that

may be associated with TD-related neurodegeneration in PD.

*Gopherus polyphemus* population distribution in Ichetucknee Springs State Park, Florida. **Sawyer Smith\* and Paul Threadgill**, Maryville College, Maryville, Tennessee. The purpose of this study was to convert manually collected gopher tortoise location data from Ichetucknee Springs State Park, Columbia County, Florida, into a digital format. ArcGIS was used to create georeferenced maps based on earlier maps that had been hand drawn by state park personnel. Maps showing the position of gopher tortoises, the distribution of land that has been used by gopher tortoises, and movement patterns of individual tortoises were produced.

Suitability of the Tumbling Creek eastern hellbender (*Cryptobranchus alleganiensis*) population as a potential source for at-risk hellbender populations. **Ridge Sliger\* and Michael Freake**, Lee University, Cleveland, Tennessee. Many isolated eastern hellbender (*Cryptobranchus alleganiensis*) populations are experiencing dramatic declines and require conservation. These populations may be preserved by augmentation using translocated individuals harvested from healthy populations. This study endeavored to determine the suitability of the Tumbling Creek hellbender population as a source population for other tributaries of the Ocoee watershed. We sought to determine that the Tumbling Creek population is a stable population with sufficient abundance to support the harvesting of individuals over multiple years without a significant probability of extinction. Using field data, a Lefkovich matrix model, and the modeling program VORTEX, it was determined that the Tumbling Creek population has approximately 20,800 individuals, is likely to be at stable age structure with high levels of recruitment, and can support yearly removal of a substantial number of individuals for 75 years without risk of extinction.

### Poster Presentations

Comparing unmanned aerial vehicles (UAVs) to traditional field methods in surveying of basking riverine turtles. **Kelly Daniels\* and Thomas Wilson**, The University of Tennessee at Chattanooga, Chattanooga, Tennessee. Unmanned aerial vehicles (UAVs) are an emerging technology that shows promise in ecological research. We would like to test their usefulness for sampling freshwater turtles. In this comparative study, we are comparing UAVs to traditional sampling methods such as basking traps and spotting scopes. UAVs have yet to be used successfully sampling freshwater turtles; however, they have been used with mixed success for monitoring mammals and birds. Herein, we propose that the conservation utility of UAVs be formally tested in the field prior to them being used to make adaptive conservation and management decisions. We will statistically evaluate the

use of UAVs in contrast to proven field methods as a means to elucidate our basic understanding of occupancy, site fidelity and species richness. Being able to successfully use UAVs for ecological surveying would provide an easy, efficient, and less invasive way to study basking turtles.

Measuring the presence of the amphibian pathogen *Batrachochytrium dendrobatidis* in east Tennessee. **Erin A. Schrenker\*, Ethan A. Carver, Jose M. Barbosa, and Thomas P. Wilson**, The University of Tennessee at Chattanooga, Chattanooga, Tennessee. We examined the presence and absence of the amphibian pathogen *Batrachochytrium dendrobatidis* in three survey areas in Eastern Tennessee. Amphibians were swabbed to assess for *Bd* and other ecological qualities like canopy cover, temperature, and watersheds were a few of the measurements evaluated. Zero animals were positive for *Bd* so correlations between presence and ecological factors in this area cannot be quantified. These results parallel other findings that few *Bd* positive assays have been conducted in East Tennessee from juveniles. Bioassessments can be a powerful tool in expanding our knowledge of *Bd* in Tennessee and can be used to focus biological hazard protocols in respect to the conservation status of amphibians.

Prevalence of *Batrachochytrium dendrobatidis* (*Bd*) in watercourses situated in southeast Tennessee. **Macall A. Nabors\*, Thomas P. Wilson, Ethan A. Carver, Jose M. Barbosa, and Team Salamander**, The University of Tennessee at Chattanooga, Chattanooga, Tennessee. The fungal disease *Batrachochytrium dendrobatidis* (*Bd*) has been correlated with amphibian decline. Numerous studies concerning the nature of *Bd* have been conducted; however, additional studies are needed to adequately evaluate *Bd* in southeastern Tennessee. Due to previous studies, the following hypotheses were proposed: watercourses in southeastern Tennessee will test positive for *Bd*, non-impacted streams will have a greater presence of *Bd* than in impacted streams, and increased canopy coverage has a positive correlation with the presence of *Bd*. Sampling took place from June 2<sup>nd</sup> 2016 to August 8<sup>th</sup> 2016 at four watercourses. DNA was extracted from 48 Plethodontid swabs with the DNeasy Blood and Tissue Kit. The results, run in triplicate, indicate that three samples of the species *Eurycea wilderae*, *Eurycea cirrigera*, *Desmognathus monticola* tested positive for *Bd*. The positive samples that indicate *Bd* prevalence in Southeast Tennessee were from Stringer's Branch and Prentice Cooper's Wildlife Management Area.

The status and conservation of the eastern hellbender (*Cryptobranchus alleganiensis*): directions for the future. **Cullen Harris\*, Paul-Erik Bakland\*, Joanna Elmore\*, David Hedrick, Nyssa Hunt\*, Austin Vanover\*, Team Salamander and Thomas Wilson**, The University of Tennessee at Chattanooga, Chattanooga, Tennessee. The eastern hellbender (*Cryptobranchus alleganiensis*) is a species of giant salamander that is native to the United States. Their

populations have declined significantly in the last 20-30 years. We have compiled a comprehensive meta-analysis that identifies the status of the eastern hellbender by state, and reviews current threats in an effort to make sound conservation decision and elucidate data gaps. Beyond this, we have communicated with state biologists to identify

conservation priorities. Lastly, we have taken a look into the conservation efforts of associated zoos, aquariums, and conservation institutes. Once implemented, our meta-analysis would be a tool for research professionals who are interested in applying adaptive conservation and management strategies to the eastern hellbender.