



# Tennessee Academy of Science

April 8, 2017

**STUDENT PRESENTATIONS**

**(concurrent sessions)**

**9:30 AM – 12:15 PM**

Hosted by the  
**Belmont University**  
College of Sciences and Mathematics

**Departments of:**  
**Biology**  
**Chemistry & Physics**  
**Mathematics & Computer Science**  
**Psychological Science**



## TAS SCHEDULE – APRIL 8, 2017

**8:30-9:15 AM** Check in and light breakfast (3rd floor atrium of Janet Ayers Academic Center)

**9:15-9:25 AM** Faculty organizational meeting in JAAC 3095.

**9:15-9:25 AM** Presenters load presentations onto computers in designated rooms.

**9:30-12:15 PM** Simultaneous sessions (see schedule below)

### **Chemistry/Physics/Mathematics Janet Ayers Academic Center Room 3081**

**9:30 – 9:45**

Synthesis, characterization, and unusual solvation and luminescent properties of terbium amine complexes. *Libby Ligon\**, *Justin Stace*, *Belmont University, Nashville, Tennessee.*

**9:45 – 10:00**

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.*

**10:00 – 10:15**

The biexciton puzzle. *David K. Zhang\**, *Daniel W. Kidd*, and *Kálmán Varga*. *Vanderbilt University, Nashville, Tennessee.*

**10:15 – 10:30**

Biotransformation of cycloastragenol and curcumin. *Howsikan Kugathasan\** and *Glenroy Martin*, *Fisk University, Nashville, Tennessee.*

**10:30 – 10:45**

A precision magnetic mapper for the UCNTau experiment. *Keegan Hoffman\** and *Adam Holley*, *Tennessee Technological University, Cookeville, Tennessee.*

## **Bio I: Ecology/Zoology/Botany**

### **Janet Ayers Academic Center Room 3085**

**9:30 – 9:45**

Decomposition rates of *Acer saccharum* and *Lonicera maackii* in mixed litter bags. **Anna Anderson\*** and **Darlene Panvini**, Belmont University, Nashville, Tennessee.

**9:45 – 10:00**

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.

**10:00 – 10:15**

Effects of acute stress on apomorphine-induced *Danio rerio*. **John Longenecker\*** and **Lori McGrew**. Belmont University, Nashville, Tennessee.

**10:15 – 10:30**

Effect of sodium chloride levels on anxiety in zebrafish (*Danio rerio*), **Austin DeMaagd\*** and **Lori McGrew**, Belmont University, Nashville, Tennessee.

**10:30 – 10:45**

The effects of isoflurane on learning and spatial memory in *Danio rerio*. **Curtis Brown\*** and **Lori McGrew**, Belmont University, Nashville, Tennessee.

**10:45 – 11:00**

Behavioral syndromes of *Elimia* snails in a predator-prey system. **Ryan Tapley\*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee.

**11:00 – 11:15**

The effect of prey size on its antipredator behavior in a snail crayfish system. **Joanna Sorrell\*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee.

**11:15 – 11:30**

The reaction of native and exotic snails to the kairomones of a native predator. **Jasmine Conyers\*** and **John Niedzwiecki**, Belmont University, Nashville, Tennessee.

**11:30 – 11:45**

The response of naïve and experienced snails to a predator cue. **Shirley Kyere\*** and **John H. Niedzwiecki**, Belmont University, Nashville, Tennessee.

**11:45 – 12:00**

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.

**Bio II: Cellular/Micro/Health Med. Sciences**  
**Janet Ayers Academic Center Room 3084**

**9:30 – 9:45**

Treatment effects of emetine on HCT-116 cells. **Kerry Sommers\***, Belmont University, Nashville, Tennessee.

**9:45 – 10:00**

Chemotaxis of *Caenorhabditis elegans* with *Bacillus thuringiensis* 4A4 in vegetative and sporulated growth stages. **Meghan McGath** and **Robert Grammer**, Belmont University, Nashville, Tennessee.

**10:00 – 10:15**

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

**10:15 – 10:30**

Expansion on the nematode scent detection test: evaluating *C. elegans* straction to non-small cell lung cancer. **Brian R. Song\*** and **Robert Grammer**, Belmont University, Nashville, Tennessee.

**10:30 – 10:45**

Seeking behaviors of nicotine. **AJ Arnold\*** and **Robert Grammer**, Belmont University, Nashville Tennessee.

**10:45 – 11:00**

Disinhibition of *C. elegans* towards *Bacillus thuringiensis*. **Samantha Bush\***, **Robert Grammer**, Belmont University, Nashville, Tennessee.

**11:00 – 11:15**

The effects of dopamine on learning and certainty in zebrafish. **Stephan Morin\*** and **Lori McGrew**, Belmont University, Nashville, Tennessee.

**11:15 – 11:30**

Caffeine's effect on chemotaxis of *C. elegans* at various stages of life. **Emily Shearon\*** and **Robert Grammer**, Belmont University, Nashville, Tennessee.

**11:30 – 11:45**

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.

**11:45 – 12:00**

The effect of piracetam on *Danio rerio* with ethanol-induced memory impairment. **Mohamed Darwish\*** and **Lori McGrew**, Belmont University, Nashville, Tennessee.

**Added late:****12:00-12:15**

Examining the effects of anandamide intake on working memory in Zebrafish. **Sam Zacovic** and **Lori McGrew**, Belmont University, Nashville, Tennessee.

## PRESENTATION ABSTRACTS

### Chemistry/Physics/Mathematics

#### Janet Ayers Academic Center Room 3081

**9:30 – 9:45**

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°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 Tb(phen)<sub>2</sub> complex also exhibits very strong visible luminescence, and fluorescence lifetime data for Tb(phen)<sub>2</sub> reveals a relatively long-lasting luminescence (~1.5 ms). Results from elemental analysis leads to speculation that the Tb(13daprop) and Tb(15dapent) complexes are polymers. The photophysics of Tb(phen)<sub>2</sub> are discussed in detail.

### **9:45 – 10:00**

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.

### **10:00 – 10:15**

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 a hole attached to a negative trion and may be a possible resolution of the discrepancy between theory and experiment.

### **10:15 – 10:30**

Biotransformation of cycloastragenol and curcumin. **Howsikan 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.

### **10:30 – 10:45**

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**

### **Janet Ayers Academic Center Room 3085**

### **9:30 – 9:45**

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.

### **9:45 – 10:00**

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.

**10:00 – 10:15**

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.

**10:15 – 10:30**

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.

### **10:30 – 10:45**

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.

### **10:45 – 11:00**

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.

### **11:00 – 11:15**

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.

### **11:15 – 11:30**

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.

### **11:30 – 11:45**

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.

### **11:45 – 12:00**

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**

### **Janet Ayers Academic Center Room 3084**

### **9:30 – 9:45**

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.

#### **9:45 – 10:00**

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.

#### **10:00 – 10:15**

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 psycho-stimulant, 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 1mM, 10mM, and 20mM caffeine.

#### **10:15 – 10:30**

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.

#### 10:30 – 10:45

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 mmol. 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.

#### 10:45 – 11:00

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*.

### **11:00 – 11:15**

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).

### **11:15 – 11:30**

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.

### **11:30 – 11:45**

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 1.6mM 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*.

#### **11:45 – 12:00**

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.

#### **12:00 – 12:15**

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.