

## ABSTRACTS OF PAPERS PRESENTED AT THE 2009 COLLEGIATE MEETINGS

## EASTERN REGION

LINCOLN MEMORIAL UNIVERSITY

HARROGATE, TENNESSEE

4 APRIL 2009

## AN INVESTIGATION INTO OSTEOPATHIC MANIPULATION TREATMENT FOR CARPAL TUNNEL SYNDROME.

**Justin Patel and Eugene de Silva**, Lincoln Memorial University, Harrogate, Tennessee. The American Osteopathic Association defines osteopathic manipulation therapy (OMT) as using the hands to diagnose, treat, and prevent illness or injury by moving major muscles and joints through various techniques including stretching, gentle pressure, and resistance. The goal of this research project is to evaluate the effectiveness of osteopathic manipulation technique for carpal tunnel syndrome versus other treatments in improving clinical outcome. The effectiveness of manipulations will further be studied by the application of physics on artificial hand models to establish a quantitative realm in treatments.

## EFFECTS OF A LATE FREEZE AND PROLONGED DROUGHT ON AN EAST TENNESSEE HARDWOOD FOREST.

**Katharine Sloop**, University of Tennessee, Knoxville, Tennessee. The repercussions of a late freeze and prolonged summer drought on a hardwood forest in East Tennessee were investigated. In April 2007, a late freeze followed an abnormally warm March. New growth on many plants was killed, delaying canopy development as shown through the normalized difference vegetation index (NDVI). In 2007, the NDVI did not reach the same peak as in previous years. An analysis of Leaf Area Index (LAI) was also used to document further effects of the freeze and/or drought on canopy development as the growing season progressed, as shown through a reduction in LAI that can be attributed to fewer leaves, smaller leaves, or a combination of the two. Compared to normal years, a delay of approximately 20 days took place in the forest's becoming a net carbon sink, and the overall productivity of the forest during the 2007 growing season, in terms of carbon fixation, was reduced to approximately 18% of the amount of carbon fixed in the baseline year (2004). Over the study period (2004-2007) rainfall in East Tennessee demonstrated a steadily decreasing trend. The combination of the late freeze, prolonged summer drought in 2007, and increased summer temperatures severely inhibited the forest's productivity, with long-term repercussions yet to be discovered.

A STUDY OF 15 *ASARUM CANADENSE* L. ACROSS THE FLOWERING SEASON IN ANDERSON COUNTY, TENNESSEE.

**Amanda Edwards, Dwayne Estes, and Paul Threadgill**, Maryville College, Maryville, Tennessee (AE, PT), and Austin Peay State University, Clarksville, Tennessee (DE). *Asarum canadense* is currently defined as a single species, based largely on

morphological characteristics determined from herbarium specimens. This study proposes pressing can obscure important floral morphological characteristics. We believe two distinct *Asarum* taxa occur in East Tennessee. The first is characterized by longer sepals. Its habitat is acidic soils like those found in the mountains and ridges. The second is characterized by shorter sepals. Its habitat is limestone soils like those found in the valleys. Eleven characteristics were measured on 15 individuals in a long sepal population on 8 sampling dates. On each date voucher specimens were collected. Vouchers are deposited at APSC. Sepal lobes never exhibited descending or reflexed orientations. The overall trend for sepals was: bud, erect, ascending, and finally horizontal. Leaf apexes were typically acute. These results support the belief that three dimensional structure of the flower is important for discerning between proposed *Asarum* taxa.

## AN INVENTORY OF REPTILES IN SUMNER COUNTY, TENNESSEE.

**Scott Gillespie and Paul Threadgill**, Maryville College, Maryville, Tennessee. Reptile species and their abundance were surveyed on a 202 ha tract of forest land near Cottontown in Sumner County, Tennessee. Using 35 pieces of metal roofing tin, search-and-seize procedures, and observation, 13 of 32 expected and one unexpected species were encountered totaling 102 specimens, with 8 additional reports made by volunteers. Species numbers ranged from a high of 18 to single occurrences. The four most commonly encountered species were the Ground Skink (*Scincella lateralis*), Five-lined Skink (*Eumeces laticeps*), Eastern Box Turtle (*Terrapene carolina*), and Northern Water Snake (*Nerodia sipedon*). The most interesting result was the first documented occurrence of a Smooth Earth Snake (*Virginia valeriae*) in Sumner County for nearly 90 years. Future work in this location should focus on the Smooth Earth Snake and Southeastern Five-lined Skink (*Eumeces inexpectatus*).

## AN INVESTIGATION INTO THE EFFECTS OF DIETING ON MOBILITY OF DOGS AND CATS.

**Hannah DeBusk and Eugene de Silva**, Lincoln Memorial University, Harrogate, Tennessee. During a period of one year, four dogs and three cats were observed to determine how obesity affected their center of gravity. The results showed that the more obese the dog or cat, the more the center of gravity was changed. The change in center of gravity then decreased the range of motion. During this period they were fed ad libitum. This study will explain how those animals were then placed on a strict diet to lose weight. Two of the dogs and one cat have lost weight. The center of gravity has returned to normal and previous health risks have decreased. A novel use of lineages in the analysis of effective population sizes of a solitary carnivore.

ANALYSIS OF CHEMOTAXIS IN PLC MUTANTS IN *DICTYOSTELIUM DISCOIDEUM*. **Max Housman**, Vanderbilt University, Nashville, Tennessee. In the social amoeba, *Dictyos-*

*telium discoideum*, cell polarity is an essential component of cell morphology during both chemotaxis and cytokinesis. In both of these processes, polarization results in the asymmetric distribution of numerous signaling and cytoskeletal components in response to external and internal cues. The regulation of phosphoinositides (PIPs) is believed to be essential for the initiation and maintenance of cellular polarity. The interconversion of PIP3 and PIP2 is essential for cell polarity and is controlled by a number of enzymes, including PI3K, PTEN, and PLC. My observations of Pleckstrin Homology (PH) domain and PTEN localization in PLC mutants imply a wild type response to the chemoattractant cAMP as well as the potential presence of an alternate pathway in the regulation of PIP2 and PIP3 localization during uniform cAMP stimulus.

**FREQUENCY CONSTANCY RELATIONSHIPS OVER MEDIUM CHANGE.** *Chris Stotts and Eugene de Silva, Lincoln Memorial University, Harrogate, Tennessee.* In the interdependent studies of music and physics it has been noted the relationships of the science and art. Each musical note possesses a signature pitch marked by a specific frequency measured in Hz. A chord is a combination of notes whose frequencies share a dynamic relationship making the sound of the arrangement pleasing to the ear of the listener. As frequency is directly related and effected by the medium through which it is propagated, the goal of this study is to test the constancy of this chord relationship through medium change. Using either stringed or tonal sound, notes from a triadic chord will be propagated through a medium of water and the frequencies recorded and compared to the control frequencies of the chord in normal atmospheric conditions. It is hypothesized that the frequencies of each individual note will be altered, however, with each note being altered, the relationship will remain constant.

**THE SCIENCE OF SINE WAVES AND HARMONY IN MUSIC.** *Jackie Martindale and Eugene de Silva, Lincoln Memorial University, Harrogate, Tennessee.* Each note played on a musical instrument produces a corresponding sine wave. When two notes are played together, the overlap in sine waves results in a harmony that may or may not be pleasing to the ear. Notes were recorded from a European silver flute and converted to sine waves by a computer program, then analyzed to determine a correlation between wavelength proportions and aural quality. It was found that ratios that are closer together produce better harmonies.

**AN INVESTIGATION INTO THE CORRELATION BETWEEN LAMENESS AND TORQUE APPLIED TO THE RIGHT FORE-LIMB OF THE HEADING HORSE.** *Tessa Garret and Eugene de Silva, Lincoln Memorial University, Harrogate, Tennessee.* An investigative study into the correlation between lameness and torque applied to the right fore-limb in roping horses with focused being placed on the heading horse. The study is on-going and is being conducted at Rolling Hills Roping Arena in Jonesville, Virginia. The study focuses on geldings and mares of the stock horse type/breed with ages ranging from 5–16 years in age. Thus far, collected results show a correlation between the force, torque, and the distance of the applied force applied over a period of time resulting in injury to the right fore-limb.

**TEACHING PHYSICS AND CHEMISTRY THROUGH SOFTWARE PROGRAMS.** *Eugenie de Silva and Eugene de*

*Silva, Missouri University, Columbia, Missouri, and Lincoln Memorial University, Harrogate, Tennessee.* This presentation will concentrate on the use of Microsoft Excel and COMSOL software programs to teach the fundamentals of physics and chemistry at college level. During the presentation, one example from each of the programs will be discussed to highlight, how in the absence of laboratory facilities, the students can be exposed to higher learning and applications of basic equations in chemistry and physics fields through these software programs.

## MIDDLE REGION

TENNESSEE STATE UNIVERSITY

NASHVILLE, TENNESSEE

18 APRIL 2009

## ORAL PRESENTATIONS

### BIOLOGY: ANIMAL AND CELLULAR BEHAVIOR

**SPECIFICITY OF ANTI-PREDATOR BEHAVIOR IN STREAMSIDE SALAMANDER LARVAE.** *Lauren Oeser and John Niedzwiecki, Belmont University, Nashville, Tennessee.* Evolutionary changes and natural selection, such as anti-predator behaviors, are important to most aspects of science. In this research, we studied the specificity of anti-predator behavior in the streamside salamander, *Ambystoma barbouri*. The previously assayed behavior of the salamander larvae was compared in the presence of their most often encountered predator, the green sunfish, along with two other closely related fish species, the warmouth and bluegill sunfish. The results show that there is a trend between fish species and degree of anti-predator behavior exhibited by the larvae. As expected, the larvae reacted strongest to the predator they encounter most often, the green sunfish, and they responded the least in the sunfish more distantly related to the green sunfish, the bluegill. These results suggest that over time the larvae have developed the ability to detect something specific to the green sunfish, their main predator.

**THE EFFECT OF LARVAL SIZE ON THE ANTIPREDATOR BEHAVIORAL RESPONSE OF THE STREAMSIDE SALAMANDER, *AMBYSTOMA BARBOURI*.** *Virginia K. Beazley and John Niedzwiecki, Belmont University, Nashville, Tennessee.* The willingness of an organism to tolerate a predation risk should be related to the potential rewards of that risk or the potential harm of inaction. We hypothesized that a tradeoff may occur over the course of larval development of the salamander, *Ambystoma barbouri*. Using *A. barbouri* and a fish predator, the Green Sunfish, a predator/prey model was set up. It is known that *A. barbouri* are sensitive to Green Sunfish chemical and this detection elicits a response from larvae. Salamander larvae were measured and randomly assigned to Green Sunfish or control water treatments and behavior was monitored. Regression analysis was used to examine the results. Although strong evidence was found to support that salamanders could detect fish chemicals and would react appropriately, there was no correlation found between size and their anti-predator behavior. It is

possible that this correlation exists between young larvae and larvae nearing metamorphosis.

**INVESTIGATING A POSSIBLE CONNECTION BETWEEN PATHOGEN AVOIDANCE AND REPRODUCTIVE OUTPUT OF *CAENORHABDITIS ELEGANS*.** *M. Christina Inman and Robert Grammer, Belmont University, Nashville, Tennessee.* In this project, the reproductive rates of five *Caenorhabditis elegans* strains were compared to the strains' survival rates when exposed to *Bacillus thuringiensis (Bt)*, to determine whether a correlation existed between reproductive rates and survival rates. This study determined whether the survival rates of the strains were different when exposed to *Bt* in fed and starved conditions. Since starvation modulates behavioral avoidance of pathogens and therefore, pathogen resistance, I should have seen a significant difference between the proportion of survivors in the starved and fed conditions. Although the presence/absence of the *C. elegans*' food source played a seemingly minute factor in the *C. elegans*' resistance, it is possible that the slightly positive correlation between survival rate and reproductive output observed in the experiment without the addition of a food source could be indicative of a confounding variable, such as an evolutionary trade-off found in the *C. elegans* natural environment.

**COMPUTATIONAL MODELING AND EMPIRICAL CONFIRMATION OF CELL SIGNALING GRADIENT FORMATION IN MICROFLUIDIC SYSTEMS.** *Arunan Skandarajah, Dawit Jawhar, Philip C. Samson, Chris J. Janetopoulos, and John P. Wikswo, Vanderbilt University, Nashville, Tennessee.* Cellular migration in response to gradients of cell signaling molecules underlies biological processes ranging from the immune response and organogenesis to cancer metastasis. VIIBRE laboratories have analyzed this response in a variety of cell types using precisely defined microenvironments provided by microfluidic devices. The purpose of this work is to characterize how the gradient that cells sense in these devices varies as a function of time. This in turn will lead to a better understanding of observed behavior. COMSOL is used to generate transient and steady-state models of gradient formation using literature-derived diffusivity data. The hypothesized models will be tested empirically by imaging the time evolution of FITC gradients. This process will allow us to conclude the accuracy, limitations, and potential applications of this modeling approach in describing the in vitro formation of cell signaling gradients.

**INFORMATION CASCADES IN A PROTOZOAN POPULATION.** *Adit Dhunmakupt and Leslie M. Shor, Vanderbilt University, Nashville, Tennessee.* It has been observed that several species of protozoa respond dynamically to chemical cues released by other members of its species or of its prey. The purpose of this experiment is to determine if the migration behavior of members of a microbial community could be described by information cascades, where sequential individuals make choices based on the actions of others. Sequential turning choices for a series of individual *Euplotes vannus*, a ciliated marine protozoa, were tracked within microfluidic channel networks in the absence of any prey signal. Preliminary data suggest that individual *E. vannus* are more likely to follow the path taken by previous individuals, suggesting the existence of an intraspecific protozoan communication mechanism.

**BIPHASIC OLFACTORY RESPONSE OF *C. ELEGANS* TO BENZALDEHYDE VIA CAPILLARY ASSAY.** *Sachin Amin and Robert Grammer, Belmont University, Nashville Tennessee.*

Previously, a standard chemotaxis assay has been utilized to measure the olfactory behavior of *C. elegans*; a capillary assay tested for avoidance; and a pirouette (sharp turn) model explained an attractive response of *C. elegans*. Here we have extended the capillary assay for the measurement of attraction (to less concentrated benzaldehyde and isoamyl alcohol odors), using naïve worms to avoid any effects of habituation or adaptation. In our modified capillary assay, the worm exhibits a positive directional change toward the attractant, which is an expansion upon the previously proposed pirouette model. We confirm many previous chemotaxis experiments centering on benzaldehyde and isoamyl alcohol. N2 animals exhibited biphasic dose response to benzaldehyde. The attractive response was reduced in tax-4 animals, while che-2 animals were completely defective in their response, showing neither attraction nor avoidance. However, osm-9 animals show strong avoidance at all tested doses, which differs from previously published results.

**PHOTOTAXIS IN WILD-TYPE AND MUTANT *CHLAMYDOMONAS RHEINHARDTII*.** *Lynette C. Rives and Robert Grammer, Belmont University, Nashville, Tennessee.*

The goal of this project was to develop a quantitative method for measuring phototaxis in *Chlamydomonas reinhardtii*. This alga responds to light using its eyespot, which senses light, and its flagella, which are its mechanism for swimming. Along with wild-type algae, two mutant forms were tested, *eye1*, lacking an eyespot, and *pf18*, lacking functional flagella. The phototaxis experiment was performed inside a pipette that had only a portion exposed to light. After some time under light the cells were drained into test tubes in portions that isolated the sections that were in the dark and the section that were exposed to the light. The biomass of the algae was measured by absorbance at 550 nm, and some experiments counted the cells microscopically. Preliminary experiments as a test of the method were performed on *Euglena gracilis*. Wild type *Chlamydomonas* responded within 10–30 minutes, whereas both mutants failed to respond at all.

## BIOLOGY: NEUROSCIENCE

**MODULATION OF L-AMINO AROMATIC DECARBOXYLASE EXPRESSION IN THE STRIATUM OF MPTP-PD MOUSE MODEL.** *Warren Dean V, Jennifer King, and Clivel Charlton, Tennessee State University, Nashville, Tennessee (WD, JK), and Meharry Medical College, Nashville, Tennessee (CC).* Parkinson Disease (PD) is a progressive neurodegenerative disorder of muscle movement characterized by tremors, muscular rigidity, bradykinesia, and postural abnormalities. One of the major therapeutic drugs for PD is L-3, 4- Dihydroxyphenylalanine (L-Dopa). Conversely, long term treatment of L-Dopa stimulates side effects. The cause of these side effects of L-Dopa therapy is unknown. We propose that the chronic effect of L-Dopa causes cycles of down regulation followed by up regulation of LAAD, leading fluctuations in dopamine (DA) production and occupation of DA receptors and thereby affecting motor control. Our results have shown that chronically treating out MPTP-PD mouse model with L-Dopa led to an early decrease in the expression of LAAD in striatum. Overall we believe that this

fluctuation in the expression of LAAD in the striatum may help to explain the fluctuation in the actions of L-Dopa.

**BLOCKING THE EFFECTS OF 6-OHDA IN *CAENORHABDITIS ELEGANS*.** *Brittany L. Myers and Nick Ragsdale, Belmont University, Nashville, Tennessee.* Parkinson's disease is a neurodegenerative disorder characterized by death of dopaminergic neurons of the substantia nigra pars compacta. *Caenorhabditis elegans* have nervous systems that are analogous to humans and therefore, can be used as a Parkinson model system. 6-hydroxydopamine was found to increase locomotor activity in *C. elegans*, due to the destruction of dopaminergic neurons. By treating *C. elegans* with imipramine, the uptake of 6-OHDA was inhibited and normal locomotor activity was recorded. Furthermore, this model system was also treated with dopamine prior to 6-hydroxydopamine, reversing the previously observed changes in locomotion. Blocking the effects of the neurotoxin 6-OHDA in *C. elegans* can provide insight and contribute to the development of new Parkinson's disease treatments.

**THE EFFECTS OF 6-HYDROXYDOPAMINE, SULPIRIDE AND SCH-23390 ON LOCOMOTION IN *CAENORHABDITIS ELEGANS*.** *Robert Gibson and Nick Ragsdale, Belmont University, Nashville, Tennessee.* 6-hydroxydopamine (6-OHDA) is a Parkinson-inducing neurotoxin. It competes with dopamine for reuptake into dopaminergic neurons. Once inside, enzymatic cleavage of 6-OHDA releases reactive oxygen species that damage and eventually destroy the neuron. This causes an overall decrease in the dopamine available to the afflicted organism, resulting in Parkinson's Disease. Previous research suggests preferential binding of the D1-family dopamine receptors, which are excitatory. In this experiment, *C. elegans* were treated with a known antagonist (sulpiride) of the D2-family dopamine receptors, which are presumed inhibitory. In addition, 6-OHDA *C. elegans* underwent treatment with SCH23390. The first group (sulpiride treatment) showed a net increase in worm velocity comparable to that observed in 6-OHDA treated worms. The second treatment group (6-OHDA + SCH23390) showed a return to normal movement velocity, i.e. SCH23390 protected against the detrimental effects of 6-OHDA. This evidence supports the current theoretical mechanism behind dopamine involvement in *C. elegans* locomotion.

**IS COGNITIVE SCIENCE RESEARCH DRIVING THE DEVELOPMENT OF FLASHCARD PROGRAMS?** *Melvin L. Williams, P. S. Kahlon, and Jeffrey D. Karpicke, Tennessee State University, Nashville, Tennessee (MK, PK), and Purdue University, West Lafayette, Indiana (JK).* We examined the extent to which these software programs are based on principles of learning and memory form. We identified 10 popular computerized flashcard programs available on the internet and evaluated six aspects of the programs: 1) Whether the program involved repeated testing of material; 2) The type of testing involved (recall vs. recognition); 3) The type of feedback given to students (presentation of the correct response vs. correct/incorrect); 4) The timing of feedback (immediate or delayed); 5) Whether flashcards were reordered or shuffled; and 6) Whether repeated items were spaced (vs. massed practice). Our results were mixed, several of the programs containing some best practices but lacking others. Repeated testing, which has been shown to enhance long-term retention, was one of the frequently used practices. Although many of the computerized flashcard

programs claimed they were based on empirical research, the majority lacked several key features that laboratory research has shown will enhance learning and long-term retention.

**THE EFFECT OF ABNORMAL CONDITIONS ON VISUAL DISCRIMINATION LEARNING IN ZEBRAFISH.** *Jaclyn Hunter and Lori McGrew, Belmont University, Nashville, Tennessee.* Zebrafish are a model organism for studies of vertebrate development, but recent studies have also shown the viability of zebrafish as a model organism for the study of behavioral plasticity and normal learning patterns. The purpose of this experiment was to determine if zebrafish could learn to visually discriminate between two colors when rewarded/punished and whether or not exposing the zebrafish to abnormal conditions, such as bright light, would affect the zebrafish's ability to visually discriminate. The findings of this experiment support the evidence found in previous studies. The zebrafish used for the first part of the experiment learned to visually discriminate in normal conditions and were still capable of visually discriminating when tested in abnormal conditions. The zebrafish used for the second part of the experiment were only exposed to the abnormal learning conditions and did not learn to visually discriminate between the two colors.

**EFFECTS OF TESTOSTERONE ON WORKING MEMORY IN *DANIO RERIO*.** *Jeanna L. Bardin and Lori L. McGrew, Belmont University, Nashville, Tennessee.* This study was chosen to explore testosterone's effects on working memory in *Danio rerio*. Working memory was assessed utilizing a basic learning paradigm and a plexi-glass maze test. The basic learning paradigm yielded learning scores based on the number of times (out of ten) a test fish chose the correct side of a tank. No significant difference was found between the learning scores of treated and untreated *Danio rerio* in the basic learning paradigm. The maze test provided a more spatial assessment of working memory in which *Danio rerio* were timed across five trials. This pilot study, despite the small sample size, yielded significant results. Testosterone-treated *Danio rerio* took almost twice as long as untreated fish to complete the test. Although the results are contradictory, this study provides a point of beginning and direction for future studies concerning the effects of testosterone on cognitive function in living organisms.

**NICOTINIC EFFECTS ON WORKING MEMORY IN *DANIO RERIO*.** *Taylor C. Walter and Lori McGrew, Belmont University, Nashville, Tennessee.* It has been previously shown that nicotine enhances working memory. However, changes in nicotinic acetylcholine receptors (nAChRs) due to nicotine exposure have not been examined. This study tests nicotinic effects on working memory in *Danio rerio* (zebrafish), and looks at the changes in nAChRs due to nicotine exposure. It was found that nicotine did not enhance working memory and nAChRs decreased as nicotine concentration increased. This work will be helpful when examining working memory disorders in humans.

**THE EFFECT OF CAFFEINE ON THE LEARNING ACTIVITY OF THE *DANIO RERIO*.** *Roshni Patel and Lori McGrew, Belmont University, Nashville, Tennessee.* Caffeine acts as an adenosine blocker in the brain. Adenosine is also linked to dopamine levels in the body. The decrease of adenosine can stimulate dopamine. This is important because dopamine is responsible for cognition in the frontal cortex which is important

for problem solving, memory, and attention. It was then hypothesized that if zebrafish are treated with caffeine this would decrease adenosine and increase dopamine in their system, leading to greater cognitive skills. To test this hypothesis a rapid learning paradigm was created, and fish were tested at three different concentrations of caffeine, 0.50 g/L, 0.25 g/L, and 0.10 g/L. The latter two concentrations showed a marginally significant result of increased short term learning.

## CANCER BIOLOGY

**OSMOTOLERANCE OF BREAST CANCER CELLS VERSUS MELANOMA CELLS.** *Joshua Mastin and Jun Song, Vanderbilt University, Nashville, Tennessee.* Determining the respective levels of osmotolerance of different cancer cells has been conducive to finding new, less destructive ways of controlling and even eradicating certain types of cancer. This experiment sought to determine the levels of osmotolerance of two different types of cancer cells: breast cancer cells and melanoma cancer cells. One sample of each type of cancer cell was exposed to an isotonic environment, serving as the control groups; additionally, one sample of each type of cancer cell was also exposed to a hypertonic environment, serving as the experimental groups. After two different periods of incubation and one centrifugation, the four samples were then stained with Trypan Blue, and the ratio of living cells to total cells was determined using hemocytometers. This experiment was run multiple times, and the results consistently showed that the melanoma cancer cells are much more resilient to osmotic pressure than the breast cancer cells.

**OPTIMIZATION OF DIMETHANOL SULFOXIMIDE IN PRESERVING HUMAN CANCER CELL.** *Olukemi Gbemisola Jolayemi and E. Lewis Myles, Tennessee State University, Nashville, Tennessee.* Preservation of Cell lines can be a very expensive process. Many labs store their cells in Liquid nitrogen. In our investigation, our goal was to determine the specific concentration of DMSO (5, 10, 15 or 20%) that would efficiently preserve our cell lines under a cryostat environment of  $-70^{\circ}\text{C}$ . We used T25 flask to initiate the experiments with 300,000 cells. The cells were frozen and periodically removed from the freezer. Cell viability was determined using Alamar Blue. Alamar Blue is a safe, nontoxic aqueous dye that is used to assess cell viability and cell proliferation and is supplied as a sterile indigo colored liquid. Alamar Blue has also been shown to be a rapid and simple non-radioactive assay alternative to the  $[3\text{H}]$  thymidine incorporation assay. Our results show that cell viability at 5, 10, 15 and 20% DMSO were very high after 6 months of storage at  $-70^{\circ}\text{C}$ .

**ANTI-CANCER COMPOUNDS EXTRACTED FROM PHYTOCHEMICAL.** *Olena McDowell and E. Lewis Myles, Tennessee State University, Nashville, Tennessee.* Secondary compounds are found in plants as products from bio-chemical pathways that are a branch of basic metabolism. They are called secondary compounds because the compounds were not part of primary metabolism. Our lab is testing plants that show potential for inhibiting the growth of cancer cells. The family Hypericaceae is known for its value as a medicinal plant. The crude methanolic extracts of these plants were tested against human metastatic cell lines representing breast (BT20 and MCF-7),

colon (SW480), and prostate (PC3) tissues. Trypan blue exclusion, and Alamar Blue were methods/assays employed to evaluate the cytotoxicity of the extracts. Analysis of the crude extracts of these plants has shown that most of them exhibit anticancer activity against the cell lines at the maximum concentration of 200  $\mu\text{g/mL}$ . In particular, three plants have demonstrated exceptional inhibitory effects with  $\text{IC}_{50}$  values ranging between 0.1–15  $\mu\text{g/mL}$ , respectively.

**THE EFFECT OF OSMOTIC STRESS ON SURVIVAL RATE OF NORMAL AND CANCEROUS MELANOCYTES.** *Samantha Duncan, Jayma Holt, Hussain Jinnah, and Sabrina Smit, Vanderbilt University, Nashville, Tennessee.* Much research has been directed at understanding the properties of cancerous cells that enable them to bypass normal apoptotic processes and display uncontrolled growth. One of the properties malignant cancer cells may have is their ability to more effectively regulate cell volume in response to osmotic stresses. The purpose of this study was to test how normal and cancerous melanocytes respond to hypertonic and hypotonic treatment. We hypothesized that cancerous cell line would display a higher survival rate than the normal cells following treatment. The survival rate of the cells was measured and compared to negative controls: normal and cancerous melanocytes remaining in isotonic solution. Initial trials tested the effect of hypotonicity on both cell lines. The data indicates that the cancerous cells have a significantly greater survival rate following treatment. Subsequent trials will test the effect of hypertonicity, and the experiment will be repeated to increase statistical power.

**SMALL COLLAGEN PEPTIDES MODULATE ANGIOGENESIS.** *Dylan R. Addis, Paul D. Piennett, M. Ryan Hudson, and Beth Conway, Lipscomb University, Nashville, Tennessee.* Angiogenesis, the generation of new blood vessels, is implicated in numerous pathological conditions including tumor metastasis. Therefore, determining the precise mechanisms regulating angiogenesis has direct relevance to the development of targeted cancer treatments. Digestion of the extracellular matrix (ECM) by numerous proteases and peptidases is known to modulate blood vessel formation. While the importance of certain proteases and the large regulatory ECM fragments they generate during angiogenesis is well-established, the precise mechanisms of cell-surface peptidases and their substrates in this process is not fully understood. We postulate that these peptidases release small, bioactive peptides from the ECM, thus controlling endothelial cell activation and angiogenesis. In support of this hypothesis, we report that small trypsin-derived collagen peptides (less than 3 kilodaltons) increase vascularization in an *in vivo* angiogenesis model. Thus, we conclude that peptidases implicated in blood vessel formation may function by releasing small ECM peptides to modulate angiogenesis.

## CHEMISTRY

**STRUCTURAL STUDIES OF O<sup>6</sup>-BENZYLDEOXYGUANOSINE ADDUCT PAIRED OPPOSITE SYNTHETIC BASE IN DICKERSON DREW DODECAMER DUPLEX (DDD).** *Elizabeth S. Muffl, Ewa A. Kowal, and Michael P. Stone, Vanderbilt University, Nashville, Tennessee.* O<sup>6</sup>-Benzyldeoxyguanosine (O<sup>6</sup>-BzG) is a bulky DNA adduct and is a natural result of exposure

to environmental carcinogens. In the DNA duplex, O<sup>6</sup>-BzG disrupts normal hydrogen bonding, and it forms a "wobble" pair with cytosine. In our studies, we paired O<sup>6</sup>-BzG opposite a synthetic *diaminonaphthyl-derived nucleoside* (dNap) to possibly reinstate normal Watson-Crick base pair. Two-dimensional NMR spectroscopy as well as x-ray crystallography techniques were used to determine the structure and stability of an O<sup>6</sup>-BzG:dNap base pair in the DDD duplex. NMR spectra show movement of the dNap base and suggest that, instead of forming normal Watson-Crick bonding, it probably intercalated between O<sup>6</sup>-BzG and the next base.

**A FIRST-ORDER KINETICS STUDY ON ATOMIC EMISSION DECAY OF TWO INORGANIC PHOSPHORESCENT COMPOUNDS.** *Kent A. Hallman, Larry D. Morris, and William A. Tallon, Lipscomb University, Nashville, Tennessee.* The phosphorescence of a strontium aluminate and a calcium aluminate compound, both doped with dysprosium and europium, were observed using an Ocean Optics Spectrometer. The emission wavelengths were found to be in the green and blue portion of the spectrum, respectively, while the excitation wavelength was in the ultraviolet. Upon removal of the excitation source, the lifetime of excited state was measured. The decay of the excited state was found to fit a model for first-order kinetic reactions.

**MICROWAVE ASSISTED DIGESTION OF CYTOCHROME C AND ANALYSIS BY SDS-PAGE AND REVERSE-PHASE HPLC IN THE UNDERGRADUATE BIOCHEMISTRY LABORATORY.** *David Jones, Gabrielle Clayton, M. Todd Garrett, Roy F. Jang, Kevin A. Lavender, Alex W. Renfro, Margarita N. Weatherman, and Kent Clinger, Lipscomb University, Nashville, Tennessee.* Sequencing of proteins is often begun by first cutting a protein into simpler polypeptides with a protease enzyme or CNBr. One of the common proteases is trypsin, which cleaves peptide bonds following a basic residue, such as arginine or lysine. This generally takes about 3–5 hours of incubation at 37°C. However, by using a microwave reactor, the time for tryptic digestion of a protein can generally be lowered to just a few minutes. Now, microwave assisted tryptic digestion and the analysis of the products can potentially be incorporated into a single biochemistry laboratory period instead of being spread over multiple weeks. The tryptic digest of cytochrome c followed by SDS-PAGE and reverse phase separation of the resulting peptides are reported in this presentation.

**THE AMOUNT OF PHOSPHORIC ACID IN COLA DRINKS AND ITS EFFECTS ON THE HUMAN BODY.** *Todd Garrett and Kent Clinger, Lipscomb University, Nashville, Tennessee.* The goal of this study is to develop an instrumental method for determining the amount of phosphoric acid in a cola drink matrix. The method should be one that can be used in an undergraduate chemistry curriculum. The method we will report on involves using Inductively Coupled Plasma Emission Spectrometry (ICPES). The motivation for measuring phosphoric acid in colas is the reported effects of phosphoric acid has on the human body decreasing the surface hardness of tooth enamel.

**LEVELS OF FATTY ACIDS IN FISH OIL DIETARY SUPPLEMENTS.** *Ainsley Villafana, Jacob Waddlington and W. A. Tallon, Lipscomb University, Nashville, Tennessee.* Omega-three fatty acids are reported to have significant health benefits. A major source of these fatty acids is fish oils. The biochemistry of omega-

three fatty acids will be briefly discussed. The results of our analysis of commercially available fish oil dietary supplements will be presented. Comparisons among several different providers of supplements will be presented. Comparisons of sample preparation methods and of HPLC and GC/MS analysis methods will be presented.

**THEORETICAL INVESTIGATION OF INTERSTELLAR PHOSPHAETHYNE.** *Million T. Mesfin and Sujata Guha, Tennessee State University, Nashville, Tennessee.* The structure and vibrational frequencies of phosphoethyne (HCP) have been examined using ab initio electronic structure calculations with different basis sets. The energetic properties of phosphoethyne also examined.

**CATALYST FREE OXAZOLIDINE SYNTHESIS USING ALDEHYDES AND KETONES WITH 2-(METHYLAMINO) ETHANOL.** *Mohammad Al-Masum and Nazanin Ghazialsharif, Tennessee State University, Nashville, Tennessee.* Oxazolidines are useful intermediates in asymmetric synthesis, and have been used as ligands for organometallic catalysts. Oxazolidine derivatives are also used as anticonvulsants in the pharmaceutical industry. In the literature, different methods for the synthesis of 1,3-oxazolidine have been reported. A recently published method uses conventional heating system for synthesis of 1,3-oxazolidine, by reaction of (2R, 3R)-3-methylamino-3-phenyl-1,2-propanediol with various aldehydes, in presence of boron trifluoride diethyl etherate as catalyst. However, microwave-enhanced, catalyst-free reactions have received much attention due to their high efficiency, and environmentally friendly characteristics. In this study, a catalyst-free method for synthesis of oxazolidine was developed, using a microwave-enhanced condensation reaction of aldehydes with ethanolamine.

**DIFFUSION AND PARTITIONING OF ORGANIC COMPOUNDS IN TO POLYDIMETHYLSILOXANE (PDMS).** *Jennifer L. Greene and Leslie M. Shor, Vanderbilt University, Nashville, Tennessee.* Polydimethylsiloxane (PDMS) has many unique, favorable characteristics that make it the current silicon organic-based polymer of choice for fabricating microfluidic devices. However, even though many microfluidic devices are made with PDMS, and many experiments use the polymer, important characteristics of the material have not been fully characterized. The goal of this study is to measure diffusion and partitioning of certain organic compounds including antibiotics as a function of PDMS formulation and surface treatments. This project will help determine if passive microbial enrichment through PDMS is possible, and if PDMS can be effective in commercial applications, including to absorb industrial and chemical wastes from aqueous solution. Additionally, the research will provide the data necessary to more accurately model and predict partitioning and diffusion effects into and out of PDMS that impact experiments using microfluidic devices.

## ENGINEERING, MATH, AND COMPUTER SCIENCE

**ECONOMIC IMPACT OF INTERVENTIONS APPLIED TO EPIDEMIOLOGICAL BIOSURVEILLANCE PROBLEMS.** *Ato*

**Wallace and Sanjukta Hota, Fisk University, Nashville, Tennessee.** This study aims to develop a model for assessing the effectiveness of intervention options in the event of an epidemic, which may adversely affect a population group. Using a productivity work loss model, optimal implementation times for various epidemic intervention strategies were found. The basic model was developed using the SIR differential equation module for epidemic outbreak, and the basic cost functions associated with interventions. Mathematical analysis was then carried out to estimate the economic impact of interventions applied to various disease epidemics. The optimal time of intervention as calculated was used to determine economically favorable detection thresholds for epidemiological biosurveillance problems. The model, within its boundary of assumptions, predicted that the total cost involved in the application of an intervention at the right time is more economical in the long run than the expected costs of lost productivity associated with restricted activity and premature mortality with no intervention.

**TARGET LOCATION ALGORITHMS AND THEIR APPLICATION IN IDENTIFYING HURRICANES. Alok Hota, Lei Qian, Sanjukta Hota, and Muthukumaran Gunasekaran, Fisk University, Nashville, Tennessee.** This paper documents a new algorithm to build off preexisting correlation matching methods to accurately find the eye of a hurricane in a static satellite image. Images of the eye of a hurricane and original satellite images were passed through correlation and Laplacian filters in order to find the pixel(s) with the best match. The results of each pixel were stored as a number from 0 to 255, with 0 being no match and 255 being an exact match. In order for one pass of the algorithm to be considered a success, the area in which the eye resided must have pixels which rated as a 90% or better match, and were at least 10% better than outlier results. Using these standards, this algorithm was found to work approximately 50% of the time, an improvement on prior methods.

**MODELLING HUMAN RELIABILITY USING FUZZY MATH TECHNIQUES. Callie Goyer and Daniel Biles, Belmont University, Nashville, Tennessee.** Human Reliability on certain tasks is affected by a number of factors such as fatigue, stress level, and workload. We present the application of fuzzy modeling to such problems.

**GREEN'S FUNCTION-BASED APPROACH TO NON-LINEAR BOUNDARY VALUE PROBLEMS. Yuliya Melnikova, Middle Tennessee State University, Murfreesboro, Tennessee.** A boundary value problem  $B_1[U(a)] = 0$  and  $B_2[U(b)] = 0$  is considered for a non-linear ordinary differential equation  $L[U(x)] + N[U(x)] = f(x)$  with  $x$  contained in the interval  $(a, b)$ , where  $B_1$  and  $B_2$  are linear operators of boundary conditions.  $L[\cdot]$  and  $N[\cdot]$  represent a linear and non-linear differential operators, respectively. The solution to this problem is proposed to be found as a limit of the sequence  $\{U_0(x), U_1(x), U_2(x), \dots\}$ , whose elements  $U_k(x)$  will be evaluated by the iterative procedure

$$U_k(x) = \int_a^b g(x,s) \{N[U_{k-1}(s)] - f(s)\} ds, k = 1, 2, 3, \dots$$

The kernel  $g(x,s)$  of the above integral represents the Green's function for the corresponding linear boundary value problem. A numerical experiment is conducted to analyze the conver-

gence rate of the sequence  $\{U_0(x), U_1(x), U_2(x), \dots\}$  for a variety of problems.

**MODEL OF MULTI-AGENT RENDEZVOUS VIA LOCAL CONTROL. S. Sathanathan and M. J. Knap, Tennessee State University, Nashville, Tennessee.** The problem considered here is the coordination of  $n$  autonomous agents, or robots. The agents can continuously communicate local information with a neighboring agent, that is another agent within its sensing boundary. The local information available is the dimensional distance from itself and the neighbor. The *multi-agent rendezvous problem* of  $n$  autonomous agents is to devise "local" control strategies, one for each agent, which without any active communication between agents, cause all members of the group to eventually rendezvous at a single unspecified location. We present the modeling issues using a system of differential equations along with simulations using *Mathematica* for the cases  $n = 2, 3$ , and 4.

**DETERMINING INDETERMINATE DIFFERENCES USING DIFFERENTIATION. Benjamin D. Briscoe, Cumberland University, Lebanon, Tennessee.** This work explores a method of evaluating certain limits in analysis, known as indeterminate differences. There are only three possible results: the difference will become infinitely positive, infinitely negative, or the two will eventually differ only by a constant. The accepted way to determine these limits is to algebraically manipulate the difference into a form that allows the use of l'Hospital's rule. The method being explored proposes that we should be able to determine which of these cases occur by evaluating the difference of the derivatives of the two functions. The motivation behind the work is to evaluate these limits, which are largely utilized in calculus and other branches of mathematical analysis, by methods which are more consistent with these areas. The results are promising and allow us to circumvent l'Hospital's rule almost completely.

**GENERATION OF OPERATIONAL PENROSE TILINGS USING AN OPTIMIZED DEFLATION ALGORITHM. Parker A. Gould and Kevin T. Seale, Vanderbilt University, Nashville, Tennessee.** Penrose tilings provide a unique way to completely tile the two-dimensional plane without translational symmetry. Tilings of this form can be useful in creating microfluidic devices for studying cell haptotaxis and decision-making in a quasi-random environment, such as the vascular system of a tumor. The algorithm presented allows for simple generation and manipulation of these patterns in both AutoCAD and MATLAB using a process called deflation. The algorithm uses the thick/thin rhombus set of Penrose tiles, the deflation of which can be accomplished given only the type and orientation of each tile. In larger deflation steps, the quantity of computations is unnecessarily increased by the presence of overlapping rhombi from simultaneous deflations. To remedy this, a repeat-removal module was incorporated into the code, significantly reducing computation time. In the AutoCAD algorithm, a module for adding variable-width channels was also incorporated to simplify and accelerate the procedure for creating microfluidic masters.

**ENGINEERING A PERFUSION-ENABLED ROTOCOMPRESSOR TO ALLOW THE ADDITION OF NUTRIENTS, CHEMOATTRACTANTS, AND DRUGS. Liwei Jiang and Chris Janetopoulos, Vanderbilt University, Nashville, Tennessee.** A rotocompressor is a mechanical device that immobilizes living

cells and small organisms for optical microscopy. Despite the rotocompressor's utility, the closed nature of the device chamber makes it unsuitable for imaging live specimens over extended periods of time. Recent modifications to the rotocompressor have incorporated two structures fabricated from polydimethylsiloxane: a microfluidic perfusion system that allows the addition of nutrients, chemoattractants, drugs, and other molecules, and a set of platforms that greatly ease the accuracy and ease of compression. Applications of the modified rotocompressor are currently focused on imaging the neural network development of *Caenorhabditis elegans* over several hours, and protein localization during signal transduction in *Dictyostelium discoideum*. The usefulness of this device extends to many different specimen types and usage scenarios.

**MICRO-PONG: A DEVICE FOR KINETIC CONTROL OF MICROFLUIDIC PARTICLES.** **Brittany A. Rohrman, Dawit Jowhar, Philip C. Samson, Dmitry A. Markov, and John P. Wikswo,** Vanderbilt University, Nashville, Tennessee. The precise control of fluid delivery is crucial in many analytical devices and may be achieved by harnessing electroosmotic flow (EOF). However, the magnitude of this flow in oxidized poly(dimethylsiloxane) microfluidic channels is known to attenuate over time. In order to characterize time-dependence of EOF in our devices, we have developed a  $\mu$ -PONG measurement system (Micro Programmable Object Navigation Gadget). It consists of a microfluidic device interfaced to a LabView program, a circuit, and a camera. The system automatically computes position of a polystyrene bead as a function of time and maintains it within a user-specified area by reversing the EOF when it approaches an edge (similar to ping pong). From the recorded motion of the bead, the three-dimensional velocity profile of the fluid in the channel is estimated and temporal changes in EOF are characterized. The  $\mu$ -PONG may also be used for precise manipulation of other particles or cells.

## ENTOMOLOGY

**STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF THE MOSQUITO DORSAL VESSEL.** **Justin D. Glenn, Jonas King, and Julian Hillyer.** Vanderbilt University, Nashville, Tennessee. Mosquitoes mount powerful cellular and humoral immune responses against microbes. Using hemolymph as a circulatory medium, phagocytic hemocytes and humoral proteins disseminate throughout the body and elicit efficient immune responses. This transport requires the dorsal vessel, a tube that pumps hemolymph throughout the body. Surprisingly, little investigation has been performed on hemolymph flow through mosquito hearts. We therefore sought to determine the mechanism by which the dorsal vessel propels hemolymph by analyzing vessel structure and contraction dynamics. Using light and fluorescent microscopy, we found that the heart contracts 82 times per minute and switches contraction direction 5 times per minute; 71% of contractions occur in the anterograde direction and 29% in the retrograde direction. Hemolymph entry/exit occurs through ostia (valves) and propulsion is achieved by contraction of muscles wrapped spirally around the dorsal vessel. These mechanical and structural examinations provide a more thorough understanding of the heart's role in circulation.

**AQUATIC MACRO INVERTEBRATES AND THE DISTRIBUTION OF *AMBYSTOMA BARBOURI* IN CENTRAL TENNESSEE.** **William Baugher and John Niedzwiecki,** Belmont University, Nashville, Tennessee. Throughout the world, amphibian species are in decline. This is a danger because they are involved in incredibly important predator-prey relationships. This research has surveyed streams for macroinvertebrate diversity and richness in an effort to locate streams suitable for the species *Ambystoma barbouri*, a mole salamander that is threatened in the state of Tennessee. According to the macroinvertebrate samples taken from 10 Central Tennessee streams, there is a strong indication that the abundance of isopods and macro invertebrates in general are an indicator of a high quality stream that is suitable for *A. barbouri*. However, these trends were not supported by statistics. Finally, although the results do not provide a strong link between macroinvertebrate diversity and *A. barbouri* occurrence, this research did result in the discovery of the salamanders in a new stream system, the drainages of the Duck River in Tennessee.

**PREVALENCE OF *TRYPANOSOMA CRUZI* IN CONENOSE BUGS (*TRITOMA SANGUISUGA*) FROM SELECTED PERIDOMESTIC AREAS IN MIDDLE TENNESSEE.** **Dana Halchak, Ludia Kim, and Steve Murphree,** Belmont University, Nashville, Tennessee. Evidence suggests an increasing prevalence of *Trypanosoma cruzi*, the causative agent of Chagas disease, in Tennessee and other southeastern states. Conenose bugs (*Triatoma sanguisuga*) are endemic to middle Tennessee and are known to serve as hosts for *T. cruzi*, however the infection rate is unknown. Conenose bugs were collected in peridomestic areas in middle Tennessee to determine the percentage infected with *T. cruzi*. Polymerase chain reaction (PCR) analysis was performed on DNA obtained from gut contents of bugs collected. Fifty percent of the DNA samples from conenose bugs ( $n = 6$ ) tested positive for *T. cruzi*. With the emerging appearance of these bugs in peridomestic settings, the need for public awareness is of great importance.

**PREVALENCE OF *TRYPANOSOMA CRUZI* IN CONENOSE BUGS (*TRITOMA SANGUISUGA*) FROM SELECTED SYLVATIC AREAS IN MIDDLE TENNESSEE.** **Ludia Kim, Dana Halchak, and Steve Murphree.** Belmont University, Nashville, Tennessee. Evidence suggests an increasing prevalence of *Trypanosoma cruzi*, the causative agent of Chagas disease, in Tennessee and other southeastern states. Conenose bugs (*Triatoma sanguisuga*) are endemic to middle Tennessee and are known to serve as hosts for *T. cruzi*, however the infection rate is unknown. Collection attempts in sylvatic areas in the Percy and Edwin Warner Parks (Davidson County) to determine the percentage infected with *T. cruzi* yielded one specimen. Polymerase chain reaction (PCR) analysis was performed on DNA obtained from the gut contents of the collected bug. DNA samples from the conenose bug specimen tested positive for *T. cruzi*. Additional specimens should be collected to determine the infection rate of conenose bugs in sylvatic areas and the public should be made aware of this potential health concern.

**MACROINVERTEBRATE DIVERSITY AND WATER QUALITY AT A TROUT HATCHERY STREAM ENTERING THE OBEY RIVER, CLAY COUNTY, TENNESSEE.** **Andrew E. Wicke, C. Steven Murphree and A. Darlene Panvini,** Belmont University, Nashville, Tennessee. Macroinvertebrates were sam-



pled from the Obey River both above and below a trout hatchery stream effluent and identified to the lowest practical taxon. Numbers of each taxon were entered in a biodiversity program and the following biodiversity indices were obtained for upstream and downstream collections: Simpson's, Shannon, and Species Equitability. Temperature, pH, dissolved oxygen content, and total dissolved solids readings were also taken above and below the hatchery stream and a water quality index was calculated. Though it was predicted that the upstream site would have higher macroinvertebrate diversity and abundance within species and better water quality, macroinvertebrate diversity and water quality were similar at both sites and more individuals of each species were found below the hatchery effluent. A possible explanation for this result is that the trout stream provides nutrients to support greater numbers of macroinvertebrates than can be supported upstream and just below the Obey River dam.

## IMMUNOLOGY AND MICROBIOLOGY

FLAME RETARDANT, TETRABROMOBISPHENOL A, INTERFERES WITH THE IMMUNE FUNCTION OF HUMAN NATURAL KILLER CELLS. *Esther Caroline Kibakaya, Krishna Stephen, and Margaret Whalen, Tennessee State University, Nashville, Tennessee.* Tetrabromobisphenol A (TBBPA) is used to reduce the combustibility of electronic and other manufactured products. Human natural killer (NK) lymphocytes are able to destroy (lyse) virally-infected and tumor cells. We examined the effects of varying concentrations of TBBPA on the lytic function of human NK cells. Exposure to TBBPA for 24 hrs caused a decrease in lytic function of greater than 90% at 5  $\mu\text{M}$  and about 39% at 1  $\mu\text{M}$ . We then examined whether the decrease in lytic function was due to a decrease in the ability of NK cells to bind to the tumor cells. Our preliminary results showed that after a 24 hr exposure, NK-cell binding to tumor cells was inhibited by about 40% at 5  $\mu\text{M}$  TBBPA, while 1  $\mu\text{M}$  caused no significant loss of binding function. Lytic function and binding assays were also carried out at 48 hr and 6 day exposures. The results were consistent with those at 24 hr.

ANTI-MICROBIAL EFFECTS OF WHITE, GREEN AND BLACK TEAS ON *SALMONELLA TYPHIMURIUM* AND *ESCHERICHIA COLI*. *Jonathan Marner, Danaka J. Hancock, Todd Gary, and E. Lewis Myles, Tennessee State University, Nashville, Tennessee.* Phytochemical has been the source of new drugs for many years. These compounds are derived from plant secondary metabolites have been applied for the treatment and/or prevention of many diseases. Natural products have recently regained importance with the increasing understanding of their biological and chemical structural diversity. The current investigation involves the examination of crude extracts of White, Green and Black teas on two pathogenic bacteria *Salmonella typhimurium* and *Escherichia coli*. Methanol extraction gave us the crude extract. Evaporation of the methanol, with a rotary evaporator made it possible to determine the actual weights of the crude extract. We dissolved the crude extract in DMSO (Dimethyl Sulfoximide). The bacteria exposure periods were 15, 30 and 60 min. The bacteria grew on solid media and incubated for 24 hours. Bacterial colonies counts determined if

any inhibition occurred. The results show that all three teas show inhibition of colony formation.

ANALYSIS OF EFFECTS OF DICHLORO-DIPHENYL-TRICHLOROETHANE (DDT) ON NATURAL KILLER CELLS. *Felicia C. Udoji and Margaret M. Whalen, Tennessee State University, Nashville, Tennessee.* Environmental exposure to carcinogenic compounds, such as dichloro-diphenyl-trichloroethane (DDT), may lead to the accumulation and proliferation of mutated cells. Normally, cytotoxic cells, such as Natural Killer (NK) cells eliminate cancerous cells by initiating apoptosis in and/or lysing the cells (lytic function). This study investigates the effects of DDT on the function of NK cells. Highly purified human NK cells were exposed to three different concentration of DDT (5 micromolar, 2.5 micromolar, and 1 micromolar) for 24 h. The ability of NK cells to lyse tumor cells was examined using a 51-chromium release assay. The results indicated that DDT drastically reduced the lytic function of NK Cell. Exposure to 5, 2.5 and 1 micromolar DDT for 24 h decreased lytic function by approximately 90, 80, and 20%, respectively. Results suggest that DDT has a deleterious effect on the ability of human NK cells to eliminate cancer cells; potentially increasing an individual's susceptibility to cancer.

COMMUNITY ASSOCIATED METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS*: A STUDY OF VIRULENCE FACTORS. *Cyrus D. Eaton and Nick Ragsdale, Belmont University, Nashville, Tennessee.* *Staphylococcus aureus* is found as both nosocomial (HA-MRSA) and Community Acquired (CA-MRSA) methicillin resistant strains. Methicillin-resistance is determined by the mec-type gene. While both CA-MRSA and HA-MRSA have these mec-type genes, CA-MRSA also carries a Panton Valentine Luekocidine gene, allows it to secrete a PVL toxin. *Caenorhabditis elegans* have also been found to show susceptibility to the bacteria *Staphylococcus aureus* as well as other gram positive and negative bacterium. Thus, these round worms serve as a model system to investigate virulence. The current study will investigate the efficacy of infections with and without different mec and PVL types. Specifically, a comparison between on mec type I and mec type III, as well as PVL positive and PVL negative, will be completed.

CONFIRMATION OF THE ROLE OF PROGRAMMED CELL DEATH AND PMK-1 PATHWAYS IN *CAENORHABDITIS ELEGANS* TO *STREPTOCOCCUS PNEUMONIAE*. *Josh Cortopassi and Nick Ragsdale, Belmont University, Nashville, Tennessee.* Humans are vulnerable to *Streptococcus pneumoniae*, which causes several deadly illnesses. The nematode *Caenorhabditis elegans* has shown an innate immunity to *S. pneumoniae* through two immune responses: a PMK-1 p38 mitogen activated protein kinase pathway and programmed cell death (PCD). In this experiment, these immune responses were confirmed in affectively fighting off *S. pneumoniae*, and a further investigation of a potential link between the PMK-1 pathway and PCD was explored. Using fluorescence and Nomarski microscopy, worms with disabled PMK-1 pathways (rendering them defenseless) were observed for visible signs of PCD. In an nsy-1 PMK-1 mutant, gonadal PCD was observed, despite a good statistical chance that this worm would die from infection. Minimal evidence prevents us from acknowledging a strong link between these two immune responses. However, given the observation of PCD in a PMK-1 mutant, additional fluorescence imaging of PMK-1 mutants may provide additional data on a potential correlation.

INCIDENCE OF METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* IN BELMONT UNIVERSITY DORMITORIES. *Alaia L. Williams and Jennifer T. Thomas, Belmont University, Nashville, Tennessee* Methicillin-resistant *Staphylococcus aureus*, MRSA, is a pathogenic, Gram-positive bacterium that is becoming more prevalent in non-hospital settings and is a chief concern for health officials worldwide, so I chose to explore its incidence on the Belmont University campus. Since *Staphylococcus aureus* (*S. aureus*) is known to thrive in conditions of moisture and skin-contact, isolates were collected from 36 Belmont University dormitory restrooms, and methicillin-resistance was determined through the disk-diffusion method. *S. aureus* colonies were found in each dormitory; the total number discovered was 496. Four dormitories of the 6 dormitories examined exhibited MRSA colonies, and 20 methicillin-resistant isolates were collected; approximately 4% of collected *S. aureus* colonies were resistant. MRSA prevalence was dependent upon location, gender, and restroom style, with the greatest incidence in Pembroke Hall, a male dormitory with community style restrooms. Overall, MRSA was relatively widespread in Belmont University dormitory restrooms, and precautionary measures need to be considered.

PRESENCE OF PBP2A PROTEIN IN METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* ISOLATES CONTAINING THE MECA GENE. *Mollie A. Schlarman and Jennifer T. Thomas, Belmont University, Nashville, Tennessee.* Since the emergence of antibiotic treatment in medicine in the 1950's, microbes have exhibited a remarkable ability to protect themselves through development of antibiotic resistance. Recently, the rapid evolution of Methicillin-Resistant *Staphylococcus aureus* (MRSA) has become an issue of urgent importance in healthcare settings. Methicillin resistance in *S. aureus* is conferred through three methods: increased levels of penicillin binding proteins, the production of beta-lactamases, and the presence of the *mecA* gene, which encodes for a unique penicillin binding protein, called PBP2a. Beyond healthcare settings, outbreaks of MRSA in the community have been reported throughout the United States, including a number of outbreaks in Middle Tennessee. Through a PBP2a latex-agglutination test, I have tested MRSA isolates from the Belmont University campus to determine their method of resistance, specifically production of PBP2a. Only two of the 16 isolates tested positive for PBP2a expression, indicating additional mechanisms of resistance for our isolates.

PRESENCE OF MECA GENE IN METHICILLIN-RESISTANT ISOLATES OF *STAPHYLOCOCCUS AUREUS*. *Anna L. Walsh and Jennifer T. Thomas, Belmont University, Nashville, Tennessee.* *Staphylococcus aureus* is a bacterium that is found on the skin and in the noses of one-third of healthy individuals. However, some strains of *Staphylococcus aureus* have developed resistance to standard antibiotics, such as methicillin and are termed methicillin-resistant *Staphylococcus aureus* (MRSA). One mechanism of resistance is the presence of the *mecA* gene which produces the PBP2a protein. Recently, cases of MRSA have been found in the community and are posing a serious threat. MRSA isolates from various athletic locations on Belmont's campus were determined by disk-diffusion assays and examined for the presence of the *mecA* gene via PCR analysis. Three of 16 MRSA isolates were positive for the *mecA* gene. As expected, all methicillin-sensitive isolates were negative for *mecA*. These data indicate mechanisms of resistance independent of *mecA* and puts into question the use of *mecA* PCR for identification of MRSA clinical isolates.

PRESENCE OF PANTON-VALENTINE LEUKOCIDIN IN COMMUNITY ASSOCIATED METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* ISOLATES ON BELMONT UNIVERSITY'S CAMPUS. *Brittany R. Moe and Jennifer T. Thomas, Belmont University, Nashville, Tennessee.* Methicillin-Resistant *Staphylococcus aureus* (MRSA) has become a major concern for public health. While it is normally seen in hospital settings with immuno-compromised patients, community-acquired strains (CA-MRSA) have become common. In addition to MRSA's resistance to standard antibiotics, increased pathogenicity has been observed in CA-MRSA strains. The presence of a Pantone Valentine Leukocidin toxin (PVL), an exotoxin that lyses host cells, accounts for this increase in disease severity. We examined whether or not CA-MRSA isolates found on Belmont University's campus contain the gene that encodes the PVL toxin through PCR analysis. Three of 15 MRSA isolates were positive for the PVL gene. Interestingly, 2 of 8 methicillin-sensitive isolates were also positive for the PVL gene. Furthermore, presence of the *mecA* gene, which confers resistance for some MRSA strains, did not correlate with expression of PVL. The presence of the PVL toxin on Belmont's campus further emphasizes the need to implement measures to decrease infection rates.

## ZOOLOGY/GEOLOGY

RESOLVING CONFLICTS IN AMBYSTOMATID SALAMANDER PHYLOGENY WITH NUCLEAR DNA. *Audrey S. Henson and John Niedzwiecki, Belmont University, Nashville, Tennessee.* Questions in evolutionary biology can be addressed and answered through phylogeny. Traditionally, phylogeny was determined through examination of morphological characteristics. However in some groups the morphological method is difficult to apply. This has been an issue facing the determination of Ambystomatid salamander phylogeny because of their reduced morphology. More recently, a molecular method using allozymes was applied to phylogenetics. While these multiple techniques often produce similar results, there are major conflicts. In this research, the amplification, sequencing and cladistic analysis of nuclear DNA was an attempt to resolve the current conflict facing Ambystomatid phylogeny. While difficulty with PCR prohibited the sequencing and analysis of nDNA, a technique was established and functioning primers were determined for a number of Ambystomatid species. The successful PCR products were purified and are ready for complete analysis in the future.

A PHYLOGENY FOR THE SALAMANDER FAMILY AMBYSTOMATIDAE BASED ON A NUCLEAR MARKER. *Alaina Reagan and John Niedzwiecki, Belmont University, Nashville, Tennessee.* Phylogenetics is the study of evolutionary relatedness among various groups of organisms. Two main approaches for studying phylogenetics are taken: morphological, the study of physical characteristics, and molecular, the study of organisms on a cellular level. Usually, these methods of study agree, but when they conflict, another direction must be taken. This is where more recently developed genetic testing can add to the pool of knowledge and potentially clear up the conflicting data. Our project takes a chromosomal DNA approach to understanding relationships between salamander species and could help confirm or disprove the already existing data and make headway with new information. We were successfully able

to amplify primers in many Ambystomatid species and we discuss some potential issues preventing successful amplification.

**LATERAL AND VERTICAL DISTRIBUTION OF GERMANIUM AND GALLIUM IN FIVE MINING LEVELS.** *Michael Gadd and H. Wayne Leimer, Tennessee Tech University Cookeville, Tennessee.* Sphalerite has been mined in central Tennessee since the early 1970's. However, the sphalerite here is unique when compared to other sphalerite found in the world because it contains germanium (Ge) and gallium (Ga). No study has been done to determine if there is a systematic variation of Ge and Ga content which may indicate a host rock control of mineralization of multiple episodes of sphalerite mineralization. Three to seven samples face and core samples were collected from each of the five mining horizons and various lateral areas. Induced coupled plasma was used to analyze dissolved sphalerite for Ge and Ga content. Analyses of the face and core samples indicate that there is no relationship between any particular mining horizon and Ge and Ga content. It appears as if host rock at neither the various mining horizons nor any lateral variation has any control on Ge and Ga distribution values.

**POTENTIAL EVOLUTIONARY PATTERNS OF PENNSYLVANIAN AGE AMPHISSITITES CENTRONOTUS (ULRICH AND BASSLER 1906) FROM THE MID-CONTINENT OF NORTH AMERICA.** *Nigel Luther and Larry Knox, Tennessee Technological University, Cookeville, Tennessee.* The late Paleozoic species *Amphissites centronotus* (Ulrich and Bassler 1906) is one of the longest enduring ostracodes known. Its earliest occurrence is in rocks of early Mississippian age, and it is last reported from the middle Permian, corresponding roughly to a duration of 70 million years, exceptionally long when compared to commonly accepted species longevity. Valentine (1970), for instance, reported that marine invertebrate species duration probably ranges between four and 12 million years. The *A. centronotus* specimens from Pennsylvanian rocks of the mid-continent of North America exhibit subtle but noticeable morphological and ontogenetic differences. The ontogenetic changes observed include, but are not limited to, the presence or absence of a carina located on the central node; migration of the central node toward the valve's posterior during growth; and the ratio of posterior valve area increase to the anterior valve area increase during late adolescence to adulthood. The measurements of these features will be used to determine significant morphological and ontogenetic changes of *A. centronotus*, helping to better define this species.

## WESTERN REGION

RHODES COLLEGE  
MEMPHIS, TENNESSEE  
4 APRIL 2009

## ORAL PRESENTATIONS

### SESSION 1

**INFLUENCE OF LUMINANCE CONTRAST IN THE AMPLITUDE OF MULTIFOCAL VEP.** *Hope B. Shackelford, Givago S.*

*Souza, Bruno D. Gomes, Malinda E.C. Fitzgerald, and Luiz Carlos de Lima Silveira, Christian Brothers University, Memphis, Tennessee, and Universidade Federal do Pará, Núcleo de Medicina Tropical, Belém, Brasil.* The purpose of this study was to compare pattern-reversal multifocal visual evoked potentials (mfVEP) at different stimulus contrast levels and eccentricities to see if mfVEP would allow distinction between the Magnocellular and Parvocellular pathways. Four subjects with normal or corrected to normal visual acuity were tested. Four achromatic stimuli with spatial Michelson contrasts of 100, 50, 25, and 12.5% were designed to test the influence of luminance contrast on response amplitude. mfVEPs were extracted and analyzed to provide signal to noise ratio (SNR) for the first order kernel (1K) and first slice of the second order kernel (2.1K). For pattern-reversal mfVEP, 1K was absent and 2.1K had 75% of reliable responses at 100% of contrast. The SNR of 2.1K was best at 25–50% contrast. Further study compared pattern-reversal with pattern-pulse mfVEP, and concluded that pattern-pulse can provide better stimulation for clinical application due to valid, above noise level responses with higher SNR.

**REAL-TIME REVERSE TRANSCRIPTASE PCR USED FOR MRNA GENE EXPRESSION IN FILAMENTOUS FUNGUS ASPERGILLUS NIDULANS.** *Chassidy Groover, Loretta Jackson-Hayes, Terry W. Hill, and Darlene M. Loprete, Rhodes College, Memphis, Tennessee.* The goal of our laboratory is to understand the mechanisms involved in cell wall metabolism in filamentous fungi. Currently, the lab is examining by Real-time reverse transcriptase PCR the differential mRNA expression of two putative *Aspergillus nidulans* mannose transporter genes that we have shown to complement Calcofluor White hypersensitivity and hyperbranching in a mutant *A. nidulans* strain. This technique combines reverse transcription and DNA amplification by polymerase chain reaction (PCR) creating fluorescent products whose production is monitored in real time. Here we show the differences in GmtA and GmtB mRNA expression during hyphal development.

**INSULIN TREATMENT OF SERUM STARVED HUMAN RETINAL MICROVASCULAR ENDOTHELIAL CELLS AND THE EFFECTS ON THE APOPTOSIS PATHWAY.** *Stephanie Parker and Jena Steinle, Christian Brothers University, Memphis, Tennessee, and University of Tennessee Health Science Center, Memphis, Tennessee.* This study investigated whether insulin prevents apoptosis in human retinal endothelial cells (HRMEC). Cells were cultured in high glucose (HG) or low glucose (LG), serum starved overnight, and then treated with 10 nM insulin for 15, 30, and 45 min. Some non-treated controls were also collected. Immunoblotting was performed as well as a caspase-3 ELISA. HRMEC cultured in HG with 15 minutes of insulin treatment showed a significant increase in the phosphorylation of Akt. Insulin treatment for 45 minutes significantly decreased cleaved caspase-3 levels in HRMEC cultured in LG. When compared to LG, HRMEC cultured in HG showed a significant decrease in cleaved caspase-3 activity at all time points. This study suggests apoptosis is reduced in HRMEC through insulin receptor regulation of Akt. Further research could investigate the mechanisms of insulin receptor signaling during diabetic retinopathy.

**MAPPING OF THE 5-HT<sub>2A</sub> RECEPTOR IN THE EDINGER-WESTPHAL REGION OF THE PIGEON (*COLUMBA LIVIA*):**

AN IMMUNOHISTOCHEMICAL STUDY. *Adam Luka, Jeremy Armstrong, Malinda E.C. Fitzgerald, and Claudio Toledo, Christian Brothers University, Memphis, Tennessee, and Universidade Cidade de Sao Paulo, Sao Paulo, Brazil.* The Edinger-Westphal nucleus (EW), the autonomic, parasympathetic component of the oculomotor complex, It is divided into two main regions. The medial (EWM) controls choroidal blood flow, important for ocular health, while the lateral (EWL) controls both accommodation and the pupillary light reflex. Serotonergic nerve fibers heavily innervate EWM, and to a lesser degree EWL. To better understand of the function of serotonin in the system, we sought to determine what receptor subtype was located on EW neurons using immunohistochemistry. It was determined that 80% of EWM neurons contained 5-HT<sub>2A</sub> receptors, while only 54% of the EWL neurons were immunopositive. These results demonstrate that the excitatory serotonergic receptor 5HT<sub>2A</sub> was in EW, suggesting that this neurotransmitter is a major contributor to the regulation of choroidal blood flow by increasing blood flow to the eye. It would also affect accommodation and pupillary functions. These results suggest a role for serotonin in ocular health.

DEVELOPMENT AND VALIDATION OF AN ONLINE EXTRACTION-LIQUID CHROMATOGRAPHY-MASS SPECTROMETRY METHOD FOR MEASUREMENT OF MK-752 IN HUMAN PLASMA. *Courtney Colotta, Feng Bai, and Clinton F. Stewart, Christian Brothers University, Memphis, Tennessee, and St. Jude Children's Research Hospital, Memphis, Tennessee.* A sensitive HPLC-MS/MS method for determination of the novel NOTCH inhibitor MK-752 in human plasma was developed using an advanced online sample preparation. Dilute plasma samples were directly injected onto an online extraction column. The sample matrix was washed; then retained analytes were eluted out and directly transferred to another analytical column for separation using a gradient mobile phase. The analyte was detected in an API-3000 LC-MS/MS System with a negative multiple reaction monitoring mode (m/z 441.1/174.8). The assay sensitivity was 5.0 ng/mL (S/N  $\leq$  10.5, %CV = 13.4, n = 3). The method was validated over a linear range of 0.05–50  $\mu$ g/mL with a R<sup>2</sup> value of 0.9979. Results from the assay within-day and between-day study demonstrated the precision (%CV) and accuracy (%Error) were  $\leq$  11.38 and  $\leq$  8.34, and  $\leq$  8.16 and  $\leq$  6.23, respectively. This method will be used to measure MK-752 in a Phase I study in pediatric patients with recurrent or refractory central nervous system malignancies.

EVALUATION OF *IN VITRO* VASOACTIVE PROPERTIES OF NEWLY DISCOVERED BK CHANNEL ACTIVATORS. *Erica C. McMorise, Anna N. Bukiya, and Alex Dopico, Christian Brothers University, Memphis, Tennessee (EM), and University of Tennessee Health Science Center, Memphis, Tennessee (AB, AD).* Impaired artery dilation is involved in prevalent diseases, such as stroke and hypertension. Treatment of these conditions might include activation of voltage- and calcium-gated potassium channels of big conductance (BK) in arterial myocytes, which causes membrane hyperpolarization, myocyte relaxation and, subsequently, arterial dilation. In the present study, newly discovered BK channel activators, such as C-10 hydroxyalkynoic acid methyl ester (10-HAME), 11-hydroxy-undec-7-ynoic acid (11-HOYA), and methyl-3-hydroxyolean-12-en-30-oate (3-HENA) were tested for their effects on resistance-size, pressurized, de-endothelized rat cerebral arteries. The well-

known BK-targeting vasodilator lithocholic acid (45  $\mu$ M) was used as positive control. Among the three compounds tested, 3-HENA (2–45  $\mu$ M) showed the highest efficacy. By testing myogenic tone responses to BK channel activators we are opening new ground for developing novel and effective arterial dilators.

OBESITY AMONG CHILDHOOD HODGKIN LYMPHOMA SURVIVORS. *Amanda S. Hoeffken and Monika Metzger, Rhodes College, Memphis, Tennessee, and St. Jude Children's Research Hospital, Memphis, Tennessee.* PURPOSE: Hodgkin lymphoma (HL) survivors are at increased risk of therapy-related long-term complications that can be further intensified by obesity. With the increased risk of obesity in the United States, it is important to characterize if Hodgkin Lymphoma survivors are at increased risk of obesity. OBJECTIVES: Identify risk factors at diagnosis that predispose the obesity in HL patients treated at St. Jude Children's Research Hospital between 1990 and 2007. METHODS: Body mass indices of 341 patients with HL were compared to NHANES data at diagnosis and last assessment. Odds ratio for obesity at last assessment was calculated. RESULTS: Obesity rate among HL survivors is comparable to that of the general population. Age at last assessment, being overweight or obese and hypothyroidism were all associated with obesity. CONCLUSIONS: Adult survivors of pediatric HL have an increased risk for obesity. Early intervention for weight control should be implemented at diagnosis.

OVER-EXPRESSION OF CKAP2 REDUCES COLONY FORMATION IN HELA CELLS. *Benjamin Jackson, Lauren Keith, and William S. Brooks, Freed-Hardeman University, Henderson, Tennessee.* Cytoskeleton associated protein 2 (CKAP2) is a microtubule associated protein that is expressed during the G<sub>2</sub>/M phase of the cell cycle. Previous publications have shown that CKAP2 plays a role in mitotic spindle functioning, although the exact nature of its function is unclear. The CKAP2 gene is frequently upregulated in human malignancies indicating that it may be involved in the oncogenic process. In this study, CKAP2 cDNA was subcloned into an expression vector system and transfected into HeLa cells. Western blotting indicated that elevated levels of exogenous protein were expressed. Using this system, a colony forming assay was conducted to determine the effects of CKAP2 over-expression on tumor cell growth. Our data indicates that in the p53-null HeLa cell line, over-expression results in a decreased number of colonies as compared with control cells. It is unclear whether this decrease in colony formation is due to cell cycle arrest or apoptosis.

A PREVALENCE SURVEY OF DOMESTIC VIOLENCE IN AN URBAN OBSTETRICAL EVALUATION UNIT. *Nakia Chambliss, Risa Ramsey, Lucinda Del Mar, William Bodeen, and Jay Bringman, Christian Brothers University, Memphis, Tennessee (NC), University of Tennessee Health Science Center, Memphis, Tennessee (RR, LD, WB), West Virginia University, Morgantown, West Virginia (JB).* Domestic violence against women is recognized as a major health concern, especially during pregnancy. The purpose of this study was to determine the occurrence of domestic violence among 100 pregnant patients of an urban obstetrical evaluation. All were screened for eligibility and consented for the study. The Abuse Assessment Screen (AAS), an anonymous survey developed by McFarlane and

associates was used to measure the significance of abuse during pregnancy. The proportion of abuse was 0.0900 (SE = 0.02862). For the 95-subject subsample of African American respondents, the proportion of abuse was 0.084211 (SE = 0.02849). One of three Hispanic respondents reported abuse. The Caucasian respondents did not report any abuse. By detection of physical abuse earlier in pregnancy psychological, physical problems and death to both mother and unborn child may be decreased. Results may allow physicians to better recognize pregnant patients who are at risk for domestic violence.

## SESSION 2

**EFFECTS OF SITTING TAI CHI ON MOBILITY OF FRAIL OLDER ADULTS.** *Alan R. Fredericks, Lawrence Faulkner, and Veronica Engle, Christian Brothers University, Memphis, Tennessee (ARF), and University of Tennessee Health Science Center, Memphis, Tennessee (LF, VE).* We sought to evaluate the effects of sitting Tai Chi, when performed for an hour, two to three times a week over a period of six months, on mobility of frail older adult residents (N = 40) in two assisted living facilities. Residents were assessed at baseline, three-months, and six-months over six months during the intervention. Mobility was measured by the Timed Up and Go (TUG) test and its components. Sitting Tai Chi did not show significant effect on the overall TUG scores or the individual TUG component scores. It is possible that frail older adults may need more than three to six months or more sessions per week of sitting Tai Chi, compared to older adults in the community performing standing Tai Chi, to have significant improvements in mobility. The study may have been under-powered. Sitting Tai Chi was enjoyable and safe for residents; with residents continuing sitting Tai Chi after the study ended.

**IMMUNE DEVELOPMENT OF *DROSOPHILA MELANO-GASTER* AT 1 AND 5 DAYS POST ECLOSION.** *Kelly Towns, Jodell Linder, and Daniel Promislow, Christian Brothers University, Memphis, Tennessee, and University of Georgia, Athens, Georgia.* Current research has focused primarily on the aging immune system in *Drosophila* and has not focused on the development of such an immune system. It is not understood how the innate immune system develops in *Drosophila*, if it develops at all in an adult fly. In this study, we investigated the average time a 5 day old and a 1 day old fly survived a bacterial infection. Our study suggests that there is a difference in survivor rate between flies that are 5 days old and flies that are 1 day old, with 5 day old flies surviving longer after infection. Our study shows that the immune system of *Drosophila melanogaster* is not fully developed at the time of eclosion.

**GENETIC EFFECTS ON ETHANOL AND OTHER BEHAVIORAL RESPONSES IN ADOLESCENTS: ANALYSIS OF ATAXIA, LOCOMOTOR ACTIVATION, AND ANXIOLYSIS IN MICE.** *Michael Antone, Kiedra Kincaide, and Kristin M. Hamre, Christian Brothers University, Memphis, Tennessee, and University of Tennessee Health Science Center, Memphis, Tennessee.* Adolescents have been shown to differ from adults on a number of behavioral responses, and many differential responses are genetically mediated. We are examining the relationship between age and genetics in behavioral responses.

Responses were examined in adolescent and adult mice of the C57BL/6J (B6), Balb/c, and DBA/2J (D2) mouse strains. Mice were tested following an IP injection of either saline or 2.25 g/kg of ethanol or at baseline (without injection). The behaviors tested included motor incoordination as measured on an accelerating rotarod, anxiolysis measured in the elevated plus maze, locomotor activation measured in an activity chamber and learned helplessness as measured in the Porsolt forced swim test. Strain differences were observed on most of the tests. However, age differences were found on only a subset of the tests. Thus, genetic effects on ethanol-related and baseline responses in adolescents occur in a test-specific manner.

**COMPARISON OF FLIGHT PATTERNS AND HABITAT PREFERENCES AMONG THE *AE. VEXANS*, *CX. ERRATICUS*, AND *AN. SMARAGDINUS* MOSQUITO POPULATIONS.** *Blake A. Jackson and Jack Grubaugh, Christian Brothers University, Memphis, Tennessee, and The University of Memphis, Memphis, Tennessee.* To characterize mosquito Diptera: Culicidae) host-seeking patterns, collections were made at discrete evening intervals from May to October 2008 at six locations representing three habitats in Shelby County, Tennessee. Abundance and flight periods were determined for *Aedes vexans*, *Culex erraticus* and *Anopheles smaragdinus* as representative species of the major culicid genera encountered during the study. *Ae. vexans*, the most widespread and abundant of the three species, was collected in the greatest numbers in late spring with peak flight periods occurring late at night. Second most abundant, *Cx. erraticus*, was prevalent in mid-summer and exhibited both a late-night and a pre-dawn activity peak. *An. smaragdinus*, which was not encountered until summer, was the least common and exhibited a primary foraging period in the early-morning hours. While the greatest numbers of culicids were collected at rural sites, no clear association was evident for any of these species to a specific habitat-type.

**ASSESSING AMPHIBIAN MARKING TECHNIQUES IN RECENT TOAD METAMORPHS: RELIABILITY, EFFECTS ON SURVIVORSHIP AND PHYSIOLOGY, AND CONSERVATION IMPLICATIONS.** *Stephanie N. Cassel, Andy Kouba, and Jon R. Davis, Rhodes College, Memphis, Tennessee (SC, JD), and Memphis Zoo, Memphis, Tennessee (AK, JD).* Global amphibian decline is a rapidly escalating and widespread problem resulting in significant reductions of amphibian populations. Reintroduction of captive-bred individuals has key implications for the conservation of imperiled species. We empirically evaluated the effectiveness of four marking techniques: Toe Clips, Visual Implant Elastomers, Passive Integrated Transponders, and Alpha-Numeric Fluorescent Tags, in identifying individual recently metamorphosed Fowler's toads (*Anaxyrus fowleri*). Additionally, we compared survival, growth rate, and physiological performance of marked toads to unmarked controls for 180 days to determine whether marks affect the measures. We anticipate marking techniques with added mass (PIT) or that affect morphology (TC) will likely have greater deleterious effects on growth, survival, and physiology. This study will identify the most reliable and least-invasive marking technique for small amphibians, which can aid population monitoring programs and improve assessment of reintroduction programs' success.

**CARBOHYDRATE DISTRIBUTION IN BAMBOO.** *Emily Wong and Carolyn Apanavicius, Christian Brothers University,*

*Memphis, Tennessee, and The Memphis Zoo, Memphis, Tennessee.* The Giant Panda is a unique animal whose diet is bamboo, a nutrient poor food. We speculated that dietary carbohydrates, such as starch and glucose, are a significant nutrient. We analyzed these dietary carbohydrates in the leaves and culm (stalk) of *Phylostachys auroesulcata* quantitatively, with an enzymatic coupling method, and qualitatively, with an independent thin-layer chromatography analysis. We found that there was a significantly higher amount of dietary carbohydrates in the upper leaves than in other parts of the plant. The enzymatic assay suggested that starch concentration was low; this was confirmed by TLC results. An average kilogram of bamboo contains about 18 g of dietary carbohydrates. A Panda's consumption of bamboo averages 12 Kg/day, from which the estimated nutrient contribution by dietary carbohydrates was about 200 g/day.

USING FECAL PARTICLE SIZE AND MICROBIAL PLATING TO GAIN A GREATER UNDERSTANDING OF THE GIANT PANDA'S DIGESTIVE MECHANISMS. *Heather Gosnell, Carolyn Apanavicius, and Rachel Hanson, Christian Brothers University, Memphis, Tennessee, and The Memphis Zoo, Memphis, Tennessee.* A method for separating Giant Pandas' fecal particles by size was developed. Fecal matter was collected from two pandas, one male and one female, at the Memphis zoo from May until July. The percentage of each particle size classification {large (> 0.75 in), medium (< 0.75 in and > 0.31 in), and small (< 0.31 in)} was determined after separation, and a greater percentage of medium particle sizes was observed in both pandas. The female had a greater percentage of small particle sizes. A second study researched the number of microbial colonies present in one milliliter of a panda's fecal slurry using a ten series dilution. Female slurry platings had greater amounts of microbes present. Combined, these studies can help determine how well bamboo is broken down (indicated by size), and give a numerical insight to the microbes present in their fecal matter.

A COMPARATIVE ANALYSIS OF NONINVASIVE TECHNIQUES USED IN MONITORING JAGUAR (*PANTHERA ONCA*) POPULATIONS. *Svetlana Lapova, Rachel Savoy, and Leandro Silveria, Christian Brothers University, Memphis, Tennessee, and Jaguar Conservation, Emas, Brazil.* Various non-invasive techniques have been developed to assess jaguar populations and to monitor general condition of the species. Non-invasive methods are key to simultaneously tracking multiple animals and protecting target species from disruptive procedures like surgeries, biopsies, and anesthesia. Our study compares two popular non-invasive techniques: camera-trapping and scat-detection. Camera-trapping involves automated cameras set up across Emas National Park (ENP), Central Brazil. Canine-assisted scat-detection is systemized collection and analysis of jaguar scats; the study was conducted in the Pantanal (Caiman Ranch), Western Brazil. The goal of the study was to compare efficiency and goals of the two techniques. Taking into account environmental conditions, population assessment capability, quality and scope of analysis (including diet analysis), and cost management, we concluded that camera-trapping was best for population monitoring while scat-detection provided a wider scope of information about sampled species. The study is ongoing; this portion was completed during the 2008 dry season.

## SESSION 3

GDP-MANNOSE TRANSPORTERS IN THE FILAMENTOUS FUNGUS *ASPERGILLUS NIDULANS*. *Laura R. Johnson, Chassidy Groover, Loretta Jackson-Hayes, Terry W. Hill, and Darlene Loprete, Rhodes College, Memphis, Tennessee.* GDP-mannose transporters (Gmt) carry nucleotide sugars from the cytosol across the Golgi apparatus membrane in various eukaryotic organisms including plants and a variety of fungi. Some fungal species including *Saccharomyces cerevisiae* express a single Gmt, while others including *A. nidulans* express two (GmtA and GmtB) whose individual roles have not been revealed. GmtA displays a punctate pattern of distribution indicative of localization within the Golgi apparatus. Here we show that GmtB localization is congruent with GmtA in mature hyphae. Also, in the lab created mutant, R205, there is a mutation in the coding region for the GmtA gene. Separate plasmids containing GmtA and GmtB as well as plasmids that encode for GmtA-GFP and GmtB-RFP chimeras complement the mutant phenotype of R205. However, GmtA and GmtB constructs complement the mutant with differing potencies. Therefore GmtA and GmtB appear to perform closely related, but distinct tasks in cell wall integrity of *A. nidulans*.

CASE STUDY OF *DEMATIACEOUS* FUNGAL INFECTIONS IN THE IMMUNO-SUPPRESSED. *Alicia Scarborough, Randall Hayden, and Gabriella Maron, Christian Brothers University, Memphis, Tennessee, and St. Jude Children's Research Hospital, Memphis, Tennessee.* This study focused on *dematiaceous* fungal infections found in immunosuppressed patients at St. Jude Children's Research Hospital. This case study was focused on a small sect of a large pool of fungal infections observed from the years 1962, the opening of St. Jude, to 2006. Twelve *dematiaceous* fungal infections were identified. The majority of these patients were white females. Forty-two of the cases were a new diagnosis. Most of the *dematiaceous* fungal infections were seen between the years of 2002 and 2006. The average length of the fungal infections was ten years. Of the twelve patients with *dematiaceous* fungal infections, 33.3% had previously received bone marrow transplants. This study provides a basis for susceptibility and duration of infection and will help provide information for further studies concerning *dematiaceous* fungal infections.

EFFICACY OF PRAZOSIN IN THE EXTINCTION AND RECONSOLIDATION OF CONTEXTUAL FEAR CONDITIONING IN RATS. *Melody Allensworth, Fabricio De Monte, and Antonio P. Carobrez, Christian Brothers University, Memphis, Tennessee, and Universidade de Santa Catarina, Florianopolis, SC Brazil.* In previous clinical studies, there has been evidence showing the effectiveness of Prazosin in the treatment of Post Traumatic Stress Disorder (PTSD), a debilitating psychological disorder associated with exposure to traumatic stress. However, there is much less evidence using animal models to support the mechanisms of effectiveness for this alpha-1 adrenergic antagonist. The aim of this current work was to investigate the blocking of an adverse memory (extinction) when Prazosin 0.1 and 0.5 mg/kg were administered in a contextual fear conditioning paradigm. Prazosin 0.5 mg/kg administered 30 minutes prior to extinction sessions on 3 consecutive days decreased the freezing behavior in comparison to the control and Prazosin 0.1 mg/kg. Our results suggested that Prazosin impedes acquisition of new learning.

**ROP2 GTPASE IS REQUIRED FOR PROPER ATFH5 LOCALIZATION IN *ARABIDOPSIS THALIANA*.** *Jenkin Chan and Jonathan Fitz Gerald, Rhodes College, Memphis, Tennessee.* Formins are conserved actin-nucleating proteins that are involved in cytokinesis and cell polarity. In yeast and animals, formins are activated by the binding of Rho GTPase. However, canonical Rho GTPases and the required formin binding domains are not apparent in plants, so the regulation of plant formin is not well understood. In this study, we examine the genetic interaction between the Arabidopsis formin, *AtFH5*, and candidate regulators. In a wild-type plant, *Atfh5*-GFP fusion protein is well-packed and is centralized slightly below the end of a growing pollen tube. In the absence of *ROP2*, a plant GTPase protein, *Atfh5*-GFP fusion protein is diffused at the end of a growing pollen tube. This result suggests that *ROP2* GTPase participates in regulating *Atfh5* during the developmental process. Though plant formins lack the conserved GTPase binding domains they may retain association with the same regulators found in animals and yeasts.

**GENERATING ESCAPE MUTANTS TO MONOCLONAL ANTIBODIES DIRECTED AGAINST H5N1 INFLUENZA VIRUSES.** *Daniel Darnell and Richard Webby, Christian Brothers University, Memphis, Tennessee, and Saint Jude Children's Research Hospital, Memphis, Tennessee.* Monoclonal antibodies (MAb) are being evaluated as a possible treatment for H5N1 influenza. The major drawback to this approach is that such treatment can rapidly generate escape mutants. An escape mutant is a virus that has mutated an antigenic epitope so that it is no longer bound by a particular antibody, thus making the virus resistant to treatment. In this study we determined the frequency of escape mutant generation to three lead MAbs; 7H5, 10C3, and 3D10. Although escape mutants were generated to all MAbs, 10C3 had to be diluted 10 fold more before mutants were detected. Correspondingly, sequence analyses showed that the 10C3 mutants mapped to a different antigenic epitope than 7H5 and 3D10, suggesting that this region was less prone to mutation. These data suggest that 10C3 is less likely to produce escape mutants and should therefore be selected for further clinical development.

**IDENTIFICATION OF SYNERGISTIC ANTIMALARIAL THERAPEUTICS FROM A COLLECTION OF BIOACTIVE COMPOUNDS.** *Michelle Paul, Rodney K. Guy, Wendyam A. Guiguemde, Christian Brothers University, Memphis, Tennessee (MP), and St. Jude Children's Research Hospital, Memphis, Tennessee (RKG, WAG).* Due to the increasing chemoresistance of *Plasmodium falciparum* against drugs that are currently used for treatment, there is an urgent need for new alternative treatments against malaria. Mortality of malaria, which is currently estimated at one million per year, is at a constant increase as a result of this chemoresistance. In response to this, a library of 5600 bioactive compounds was tested in combination with two known antimalarials to identify possible synergistic antimalarial pairs. From the screening, twelve compounds were identified as synergistic in combination with the antimalarial artemisinin, and thirteen compounds hits with the antimalarial chloroquine. Of these synergistic hits, sixteen have no previously published growth inhibition activity against the parasite.

**CHROMATIC DISCRIMINATION MEASURED WITH MFVEPS.** *Stephanie Johnson, Bruno D. Gomes, Givago da Silva*

*Souza, Malinda E.C. Fitzgerald and Luiz Carlos de Lima Silveira, Christian Brothers University, Memphis, Tennessee, and Universidade Federal do Pará, Núcleo de Medicina Tropical, Belém, Brasil.* The purpose of this study was to investigate asymmetries with respect to sensitivity to chromatic stimulation using multifocal visual evoked potentials (mfVEPs). A stimulus consisting of a dartboard pattern of 120 sectors at 75 Hz frame rate was used. Luminance increments were applied to obtain 100, 50, 25, 12.5, and 0% Michelson contrasts, starting from either the red or green phosphor. Analysis showed that the response energy was concentrated in the second-order kernel in the first and second central rings. The responses increased from the isoluminance condition to reach a peak at 50% contrast in the green side and 12.5% contrast in the red side of the tested range of luminance contrasts. At 100% contrast, red-black darts evoked larger responses than green-black darts. Multifocal VEP responses exhibited an asymmetric behavior when red-green dart stimulus moves from the isoluminance condition towards a pure red or green luminance contrast.

**EFFECTS OF PLATELET-RICH PLASMA ON PIG DERIVED ANNULUS FIBROSUS CHONDROCYTE PROLIFERATION.** *Scott C. Berry and Richard Smith, Christian Brothers University, Memphis, Tennessee, and University of Tennessee Health Science Center, Memphis, Tennessee.* Intervertebral disc (IVD) degeneration generally begins with damage to the annulus fibrosus (AF). If the damage can be easily treated, then it would be possible to stop the progression of IVD degeneration before the nucleus pulposus (NP) begins to collapse. In this study, platelet-rich plasma (PRP) is tested as a possible treatment for IVD degeneration as it pertains to damage of the AF. AF derived chondrocytes, from the spine of a pig, were cultured with PRP and various platelet concentrations. RNA was extracted and quantitative PCR was performed for the genes *mmp-1*, *col-1*, *col-2*, and *aggrecan*. The samples treated with PRP showed an increase in expression of *col-1* and *col-2*, and a decrease in expression of *mmp-1* and *aggrecan*. This shows that collagen breakdown is minimal and there is an increase in chondrocyte proliferation compared to nontreated controls. These results demonstrate a potential of PRP to promote AF chondrocyte proliferation.

**DIRECT DELIVERY OF EPO IS NEUROPROTECTIVE TO PHOTORECEPTORS INDEPENDENT OF GLYCOSYLATION.** *Ying Y. Wong, Shayla Merry, Kishore Kodali, and Tonia S. Rex, Christian Brothers University, Memphis, Tennessee (YYW), and University of Tennessee Health Science Center, Memphis, Tennessee (SM, KK, TSR).* We sought to determine if direct delivery of erythropoietin (EPO) or its glycosylated variants, deglycosylated EPO (DEPO) and hyperglycosylated EPO (HEPO) are able to protect the photoreceptors of retinal degeneration slow (rds) mice from dying of apoptosis. On postnatal day 7 rds mice were given a single subretinal injection of EPO, DEPO, HEPO, or phosphate buffered saline. Apoptotic cells were detected by TdT-dUTP nick end labeling (TUNEL) of retinas at postnatal day 20 (the peak of apoptotic cell death). Hematocrit levels were measured by capillary centrifugation. We detected  $36 \pm 3$  TUNEL + cells/mm retina in untreated rds mice. Buffer, EPO, HEPO, and DEPO treated retinas had  $16 \pm 4$ ,  $2 \pm 1$ ,  $3 \pm 2$ , and  $7 \pm 1$  TUNEL + cells/mm retina, respectively. There was no change in percent hematocrit. EPO is neuroprotective to the photoreceptors in the rds mouse without a