



**Fifth Annual  
Science Undergraduate  
Research Symposium**

**Thursday, December 4, 2008**

**KEYNOTE ADDRESS**

**“White Light Emitting Nanocrystals and the Coming Revolution in Energy  
Efficient Solid State Lighting”**

**Dr. Sandra Rosenthal  
Department of Chemistry  
Director, Vanderbilt Institute of Nanoscale Science and Engineering  
Vanderbilt University  
4:00 PM**

**STUDENT POSTER SESSION**

**5:00 – 6:00 PM**

**STUDENT ORAL PRESENTATIONS**

**(Simultaneous sessions)**

**6:15 – 7:45 PM**

# POSTER SESSION

Beaman Lobby

5:00-6:00 PM

## Biology

### **“Biphasic Olfactory Response of *C. elegans* to Benzaldehyde via Capillary Assay”**

Sachin H. Amin

Faculty Advisor: Robert T. Grammer, Ph.D.

Major: Biology

Previously, a standard chemotaxis assay has been utilized to measure the olfactory behavior of *C. elegans*. More recently, a capillary assay was developed to test for avoidance. Here we have extended the capillary assay for the measurement of attraction (specifically, less concentrated benzaldehyde and isoamyl alcohol odors), using naïve worms to avoid any effects of habituation or adaptation. It has been shown that the frequency of pirouettes is lower in an odor gradient than in uniformly distributed odor. In effect, when a worm senses an attractive odor, then the frequency of reversals is reduced; thereby the overall motion of the worm is in the direction of odor strength. While the pirouettes result in a reversal of direction, in our modified capillary assay where the capillary with attractive odor is presented at a right angle, a pirouette is utilized by the worm such that a positive directional change toward the attractant results. As part of this experiment, we have confirmed many of the previous chemotaxis experiments centering on benzaldehyde and isoamyl alcohol. N2 animals exhibited the characteristic biphasic dose response to benzaldehyde indicating that the aversive response is not due to habituation. 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.

### **“The Effects of Testosterone Treatment on Conditioned Responses in *Danio Rerio*”**

Jeanna Bardin

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

Testosterone is an androgen that is known to evoke multiple external effects including development of secondary male characteristics, stimulation of aggressive behavior, and anabolic characteristics. Its internal effects on the central nervous system, however, are not as clear. This study attempts to better understand testosterone's effect on the brain and its impact on memory. Zebrafish, *Danio rerio*, a widely utilized vertebrate model system, were used for this evaluation. Fish were treated with concentrations of testosterone ranging from 2 to 200 µg/ml for 30 minutes prior to testing. Fish were trained using a rapid conditioning learning paradigm. Briefly, the zebrafish were taught to choose the one side of an aquarium by associating punishment with the alternate side. Learning was evaluated based on the percentage of times that fish chose the “correct” side (associated with no punishment). Data suggested no significant difference between control and treated zebrafish. A second measure of learning used a maze in which zebrafish were timed across several trials to assess working memory based on spatial recognition. Non-parametric data analysis showed slight significance. In conclusion, testosterone was observed to have negligible effect on working memory in zebrafish tested using these spatial recognition paradigms, but further work is required. Future studies using color discrimination and mate recognition are planned.

### **“Macroinvertebrates and the Distribution of *Ambystoma barbouri* in Tennessee”**

William Baugher

Faculty Advisor: John Niedzwiecki, Ph.D.

Major: Biology

The Streamside salamander, *Ambystoma barbouri*, breeds in limestone bedrock streams of central Kentucky, southeastern Indiana and southwestern Ohio. It has recently been discovered in the central basin of Tennessee. Despite an intense search of the Stones River drainage it is only known from a few streams there. In this experiment, we studied macroinvertebrate communities of five streams with salamanders and five similar streams that did not have salamanders to determine if we could detect water quality differences between the two types of stream. This study could indicate the water quality requirements of Streamside salamanders, or aid in identifying new breeding streams. We measured, total abundance, the abundance of isopods (a major salamander food source), and Shannon's Index. Although we saw trends for larger and more diverse macroinvertebrate communities in salamander streams, none of these differences were significant when compared with a t-test. These results may

be due to our relatively small sample size, or these parameters may just not be sensitive enough to predict likelihood of salamander breeding. Further work is needed if we are to protect these rare salamanders in Central Tennessee.

### **“Does Size Influence Antipredator Behavior in the Streamside Salamander, *Ambystoma barbouri*”**

Virginia Beazley

Faculty Advisor: John Niedzwiecki, Ph.D.

Major: Biology

The willingness of an organism to endure predation risk, should be related to the potential rewards of that risk or the potential harm of inaction. Those rewards may vary even over the lifespan of an individual. We hypothesized this tradeoff may occur over the course of larval development of the streamside salamander, *Ambystoma barbouri*. Few individuals grow fast enough to make it to metamorphosis so small individuals should be willing to chance predation while individuals who are larger and closer to metamorphosis should be more cautious. To determine whether body size was related to their anti-predator response, experiments were performed measuring behavioral responses to chemical cues from the predatory sunfish, *Lepomis cyanellus*. A regression analysis was used to determine if a relationship between size and antipredator response existed. In our experiment no correlation was found between the size and anti-predator response in these salamanders. While there was variation in size of our salamanders all were well into development. If such a risk/reward differential exists it may be between very early larvae and later larvae. More research must be performed in order to find this correlation.

### **“Confirmation of Programmed Cell Death and Pmk-1 Pathways in *Caenorhabditis Elegans* to *Streptococcus Pneumoniae*”**

Josh Cortopassi

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

*Streptococcus pneumoniae* is a common bacterial pathogen for humans. This bacterium is responsible for a host of diseases ranging from otitis media to meningitis. Recent studies in a *C. elegans* model have shown the necessity of the PMK-1 pathway for survival. Additional, work in this same model has shown an increase in survival when program cell death (PCD) occurs in the gonadal region. The current investigation wished to confirm the PCD results as well as try to elucidate any connections between the PMK-1 and PCD pathways. While the protective effect of PCD was confirmed, the current study was unable to link the two pathways.

### **“Investigating Mortality Rates Caused by *Mec* Type and *PVL* Type in *Staphylococcus Aureus*.”**

Cyrus Eaton

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

*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.

### **“The Effects of Sulpiride, Sch23390 and Dihydroxydopamine HCl 6-OHDA Treated *Caenorhabditis Elegans*”**

Robert Gibson

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

Parkinson's disease is a highly debilitating disorder that greatly decreases the quality of life of those affected. 6-hydroxydopamine (6-OHDA) has been used to induce neural degeneration in dopaminergic neurons. The observed degeneration mimics the loss of dopaminergic neurons seen with Parkinson's disease. Previous research showed in *C. elegans* showed an unexpected increase in locomotion in 6-OHDA treated worms. The current investigation attempts to determine if the previous result is caused by preferential binding of available dopamine to the excitatory D1-family or the inhibitory D2-family of receptors. Initial results suggest that D1 receptors play a role in increased worm locomotion.

### **“Prevalence of *Trypanosoma cruzi* in Conenose Bugs (*Triatoma sanguisuga*) from Selected Peridomestic Areas in Middle Tennessee.”**

Dana Halchak

Faculty Advisor: Steve Murphree, Ph.D.

Major: Biology

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.

### **“Resolving Conflicts in Ambystomatid Salamander Phylogeny using Nuclear DNA”**

Audrey Henson

Faculty Advisor: John Niedzwiecki, Ph.D.

Major: Biology

Understanding phylogenetic relationships is important to understanding the evolution of traits within a group. Traditionally, morphological comparisons and molecular methods have been used to determine phylogeny. While they are often in agreement, sometimes these methods lead to conflicting interpretations of phylogeny. In Ambystomatid salamanders, there are major differences between the most recent morphological and molecular trees, especially with the monophyly of the linguaelapsus group. In our study we hope to add several new and independent lines of molecular evidence to help resolve this phylogeny. We will amplify sequences from 2-3 unlinked loci from each of 12-15 species of ambystomatid salamanders using the polymerase chain reaction (PCR). PCR products will be sequenced and aligned, then we will use the programs PAUP\* and mrbayes, to compute the most likely and most parsimonious phylogenetic arrangements of the taxa. We hypothesize that new molecular data will support the current molecular phylogeny based on allozymes, since we suspect the possibility of non independence of characters in the morphological tree. Phylogeny based on each new locus will help provide a clearer picture of the evolutionary history of this group.

### **“A Demographic Analysis of the Rainbow Trout Population on the Caney Fork River”**

Dave Henton

Faculty Advisor: A. Darlene Panvini, Ph.D.

Major: Biology

This study analyzes several environmental factors to determine a possible influence on individual weight, length, and condition factor for stocked rainbow trout (*Oncorhynchus mykiss*) in the tailwaters of the Caney Fork River, Tennessee. Using spinfishing and flyfishing techniques, fish were harvested from three sites for nine days each over a three month period in summer 2008. Water samples were collected from each site and analyzed for dissolved oxygen, turbidity, and temperature. Each fish was measured for length and weight, and a fulton-type condition factor was used to assess fish health. No significant differences were found in environmental quality, fish length, weight, or health among the three sites. A comparison of the condition factors in this river to those published for rainbow trout suggests that the Caney Fork population may be less plump than the average for the species. Further research may reveal possible correlations between fish well-being and environmental factors in the Caney Fork River.

### **“The Effect of Abnormal Conditions on Visual Discrimination Learning in Zebrafish”**

Jackie Hunter

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

Zebrafish, *Danio rerio* are a model organism commonly utilized 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. *Danio rerio* are small tropical fish, typically found in fresh water streams and rice paddies of East India, Bangladesh, and Burma. Previous studies have shown that zebrafish are able to perceive colors in the visible spectrum along with some ultraviolet wavelengths. Light has a limited ability to penetrate water, so that fish adapted to have good visual acuity in dim light have a selective advantage. Additional studies have demonstrated the visual acuity can be impaired by embryonic exposure to abnormal light conditions such as bright light. The purpose of this experiment was to determine whether adult zebrafish could learn to visually discriminate between two colors and whether or not exposing adult zebrafish to abnormal conditions, such as bright light, would affect the fish's ability to discriminate. This study showed that zebrafish trained under normal light

conditions, learned to visually discriminate in normal conditions and were still capable of visually discriminating when tested under abnormal conditions. Zebrafish that were only exposed to the abnormal learning conditions did not learn to visually discriminate between the two colors.

### **“Investigating a Possible Connection Between Pathogenic Avoidance and Reproductive Output of *Caenorhabditis elegans*”**

Margaret Christina Inman

Faculty Advisor: Robert Grammer, Ph.D.

Major: Biology

In this project, the reproductive rates of five *Caenorhabditis elegans* strains were compared to the strains' survival rates when exposed to a known pathogen, *Bacillus thuringiensis* (*Bt*), to determine whether a correlation existed between reproductive rates and survival rates. Hasshoff et al. (2007) demonstrated the role of DAF-2 insulin-like receptors (ILR) in *C. elegans*' behavioral avoidance of pathogenic *Bt*. The behavioral responses include increased physical evasion and reduced oral uptake of *Bt* (Schulenburg and Ewbank, 2007). Inhibition, or down-regulation, of these receptors indirectly results in greater pathogen resistance, longevity, and stress resistance through these behavioral responses (Hasshoff et al., 2007). Using my data, I wanted to determine whether a correlation existed between the reproductive rates of *C. elegans* strains and their survival rate when exposed to *Bt* in two conditions: fed and starved. Starvation modulates DAF-16 activity and therefore, pathogen resistance (Schulenburg and Ewbank, 2007). If starvation had modulated DAF-16 activity, then I should have seen a significant difference between the proportion of survivors in the starved and fed conditions. However, my research shows that starving the worms did not lead to greater resistance because the proportions of survivors were the same for both experiments. 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 another effect of down-regulating DAF-2 ILR: greater reproductive output as a behavioral resistance to pathogens.

### **“Prevalence of *Trypanosoma cruzi* in Conenose Bugs (*Triatoma sanguisuga*) from Selected Sylvatic Areas in Middle Tennessee”**

Ludia Kim

Faculty Advisor: Steve Murphree, Ph.D.

Major: Biology

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.

### **“Presence of Pantone-Valentine Leukocidin in Community Associated Methicillin-Resistant *Staphylococcus aureus* Isolates on Belmont University's Campus”**

Brittany R. Moe

Faculty Advisor: Jennifer T. Thomas, Ph.D.

Major: Biology

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 and is associated with necrotizing pneumonia, accounts for this increase in disease severity. The goal of our research is to examine whether or not CA-MRSA isolates found on Belmont University's campus contain the gene that encodes the PVL toxin through PCR analysis. It is important to identify these highly pathogenic strains in community settings so that measures can be implemented to avoid infection.

### **“Blocking the Effects of 6-OHDA in *Caenorhabditis Elegans*”**

Brittany Myers

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

Parkinson's disease is a neurodegenerative disorder affecting the dopaminergic neurons of the substantia nigra pars compacta. The neurotransmitter, dopamine, found in this area, regulates many things including locomotor activity. *C. elegans* have nervous systems that are analogous to humans, and therefore, may be used as a Parkinson model system. Previous studies have found the neurotoxin, 6-OHDA, increases locomotor activity in *C. elegans* creating Parkinsonian like symptoms. To confirm that the observed effects in previous studies were due to interrupting dopaminergic neuronal signaling, the current investigation blocked uptake of 6-OHDA or provided exogenous dopamine concurrently with 6-OHDA followed by monitoring of any changes in locomotion. Blocking the effect of 6-OHDA or giving exogenous dopamine to *C. elegans* reversed the changes in locomotion previously recorded.

### **“The Specificity of Antipredator Behavior in the Streamside Salamander, *Ambystoma barbouri*”**

Lauren Oeser

Faculty Advisor: John Niedzwiecki, Ph.D.

Major: Biology

Natural selection should produce behaviors in animals that increase fitness within the conditions an organism is exposed to, but not necessarily perfectly adapted to novel conditions. A good model system for this question is the fish predation on the streamside salamander, *Ambystoma barbouri*. The previous research on *A. barbouri* has found that the larvae are able to detect and respond to chemicals associated with their main predator, the green sunfish, but they do not respond to the related blue-gill sunfish. In our experiment, I hoped determine the specificity of cue and receptor to the anti-predator behavior, by testing the behavioral reaction of the streamside salamander larvae to the presence of water previously holding control, bluegill, warmouth, and green sunfish. By measuring shelter use, time in water column and movement behavior, our data showed that larvae respond significantly more to the presence of green sunfish, than other fish. Warmouth sunfish, which is more closely related to the green than a bluegill showed a slightly stronger response in some measures than the bluegill sunfish, though Larvae showed significantly increased antipredator behavior than clean water controls. We conclude that salamanders show some response to all sunfish cues, but show the strongest response to the sunfish presumed to have the largest effect on them. The observation that the closely related warmouth produced stronger results than bluegills suggests a possible role for evolutionary history to shape the behavioral response through variation in the cue chemical.

### **“Caffeine's Effect on the Learning Activity of *Danio rerio*”**

Roshni N. Patel

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

Caffeine acts as an adenosine blocker in the brain. Adenosine is the nucleoside that is responsible for promoting in sleep. It is found throughout the body and is a byproduct of cell work. Caffeine is similar in structure to adenosine which is important because it is this shape that allows caffeine to effect neural receptors that would normally react to adenosine. 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. If caffeine can inhibit the reception of adenosine and adenosine inhibits dopamine, this would indicate that an increase in caffeine would increase dopamine. It was than 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, .50 g/ L, .25 g/L, and .10 g/L. The latter two concentrations showed a marginally significant result of increased short term learning. The data can provide information on how caffeine plays a significant role in the function of short term memory, which may offer insight into the significance of learning techniques of students.

### **“A Phylogeny for the Salamander Family *Amblymatidae* Based on a Nuclear DNA marker”**

Alaina Reagan

Faculty Advisor: John Niedzwiecki, Ph.D.

Major: Biology

Often experiments that incorporate and compare morphological and molecular tests on a model organism find both lines of evidence in agreement. However, sometimes, the two forms of data are incongruent and questions arise about which information

is correct. My project addresses a conflict in the phylogeny of the salamander family *Ambystomatidae* based upon molecular markers and an earlier morphology based phylogeny, especially with the morphologically supported *Ligulapsus* group. To resolve this conflict, I am amplifying and sequencing 3-4 unlinked genes from two to three individuals (from different populations) representing 15-20 species of salamander. Sequences will be aligned and parsimony- and maximum likelihood trees will be generated using PAUP\*. By comparing phylogenies based on the multiple chromosomal DNA loci to the morphological and mitochondrial systems, we should have an idea which, if either, is correct. If the mitochondrial data is supported, it is evidence for convergent evolution among salamanders for the *ligulapsus* feeding morphology. If the morphological data is confirmed, care in interpreting other phylogenies based on limited molecular data.

### **“Phototaxis in wild-type and mutant *Chlamydomonas reinhardtii*”**

Lynette C. Rives

Faculty Advisor: Robert T. Grammer

Major: Biology

The goal of this project is 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, I am testing two mutant forms, *eye1*, lacking an eyespot, and *pf18*, lacking functional flagella. The phototaxis experiment is performed inside a pipette that will have only a portion exposed to light. After some time under the light the *Chlamydomonas* are drained into test tubes in portions that isolate the sections that were in the dark and the section that was exposed to the light. The biomass of the algae is measured by absorbance at 550nm.

### **“Presence of PBP2a Protein in Methicillin-Resistant *Staphylococcus aureus* Isolates Containing the *mecA* Gene”**

Mollie A. Schlarman

Faculty Advisor: Jennifer T. Thomas, Ph.D.

Major: Biology

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.

### **“Comparison of Photosynthesis and Transpiration Rates in *Lonicera Maackii* and *Symphoricarpos Orbiculatus* in Response to Environmental Factors”**

April L. Tummins

Faculty Advisor: A. Darlene Panvini, Ph.D.

Major: Biology

Invasive exotic species appear to be more prevalent in urban environments than rural settings. The disturbance and fragmentation on wooded sites due to developing urban areas could provide favorable settings for exotic species. CO<sub>2</sub> and light levels are two major environmental factors that can change as a result of disturbance and fragmentation. An invasive exotic species, *Lonicera maackii*, and a native species, *Symphoricarpos orbiculatus*, were exposed to varying levels of CO<sub>2</sub> (50, 100, 200, 300, 400, 600, 800 μmol mol<sup>-1</sup>) and PAR (0, 20, 50, 100, 200, 500, 1000, 1500, 2000 μmol photons m<sup>-2</sup> s<sup>-1</sup>) to compare the species' responses in photosynthesis, transpiration, and water use efficiency using a LI-6400. The exotic species had higher rates of photosynthesis but comparable rates of transpiration at all levels of CO<sub>2</sub> and PAR compared to the native species, resulting in an overall greater water use efficiency in *Lonicera*. The data suggest that exotic species respond favorably to the increasing CO<sub>2</sub> and light levels that accompany urbanization.

### **“Presence of *mecA* Gene in Methicillin-Resistant Isolates of *Staphylococcus aureus*”**

Anna L. Walsh

Faculty Advisor: Jennifer T. Thomas, Ph.D.

Major: Biology

*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). The majority of MRSA isolates possess a *mecA* gene which confers resistance. MRSA has been found in hospital settings for the past 20 years. Recently, however, cases of MRSA have been found in the community and are posing a new threat. Our goal is to identify MRSA isolates on Belmont's campus and see if their resistance is made possible through *mecA*. Isolates of *Staphylococcus aureus* were obtained from various athletic locations on campus and methicillin-resistant strains were identified using the disk-diffusion method. DNA from these isolates was then extracted and amplified by PCR using *mecA* primers. Our results will begin to characterize the isolates present in the Belmont community.

### **“The Effects of Nicotine on Learning and Acetylcholine Expression in *Danio rerio*”**

Taylor C. Walter

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

It has long been known that nicotine can enhance short-term cognitive processes (Levin et al. 2006). It is thought that Nicotine enhances memory via the pre synaptic  $\alpha$ -7 receptor and the post synaptic  $\alpha$ 4 $\beta$ 2 receptor pathway (Kelley A., 2002). Past undergraduate research indicates that *Danio rerio* learn best when treated with 5 $\mu$ M of nicotine as opposed to 0  $\mu$ M or 10 $\mu$ M. This study examined the exact concentration of nicotine that produces the highest learning level in zebrafish as well as the correlation between learning and acetylcholine receptor  $\alpha$ -7 expression. It was hypothesized that nicotine enhances cognition best at a concentration of 5  $\mu$ M and as a result there will be higher expression of acetylcholine  $\alpha$ -7 in fish treated with 5  $\mu$ M of nicotine. To test learning ability, 40 fish were treated with 0  $\mu$ M, 4  $\mu$ M, 5  $\mu$ M, or 6  $\mu$ M of nicotine (10 treated with each concentration) and examined using a learning paradigm. A Western blot was then performed to examine levels of acetylcholine in 4 fish (1 per concentration). It was found that the untreated fish had the highest learning percentage and the highest expression of acetylcholine. This was significantly different from the fish treated with 4  $\mu$ M and 6  $\mu$ M of nicotine. This data suggests that nicotine does not play a role in enhancing short term cognition, but does give insight into the link between learning and expression of nicotinic receptor  $\alpha$ -7.

### **“Incidence of Methicillin-Resistant *Staphylococcus aureus* in Belmont University Dormitories”**

Alaia L. Williams

Faculty Advisor: Jennifer T. Thomas, Ph.D.

Major: Biology

Methicillin-resistant *Staphylococcus aureus*, MRSA, is a highly pathogenic, Gram-positive bacterium present in many community settings, especially those where skin-to-skin contact is common. MRSA infects the skin, bloodstream, and surgical wounds; it is a chief public health issue worldwide, including middle Tennessee. In this experiment, *S. aureus* isolates were collected from thirty-six Belmont University dormitory restrooms. Methicillin-resistance was determined through the disk-diffusion method. *S. aureus* colonies were found in varying amounts in each dormitory; the total number discovered was 496. Four dormitories of the six dormitories examined exhibited MRSA colonies, and twenty methicillin-resistant isolates were collected; approximately four percent of collected *S. aureus* colonies exhibited resistance. These isolates exhibited zones of inhibition ranging from zero to ten millimeters, indicating that degrees of resistance varied. Methicillin-resistant *S. aureus* is relatively widespread in Belmont University dormitory restrooms, and precautionary measures may need to be considered.

## **Biochemistry and Molecular Biology**

### **“Isolation of Astaxanthin from *Procambarus clarkii*”**

Emily A. Karr

Faculty Advisor: Dr. Rachel Rigsby, Ph.D.

Major: Biochemistry and Molecular Biology

Carotenoids are components in the body that are essential for the removal of free radicals. Left unattended free radicals can cause cancer, autoimmune diseases, iron overload, and neuronal diseases. Astaxanthin is an orange or red carotenoid present in shrimp, crawfish, crabs, salmon, lobsters, and rainbow trout. It exhibits superior antioxidant properties to most carotenoids.

There has developed a need for synthetic astaxanthin as a supplement for farm raised fish. It compensates for the lack of natural pigmentation and prevents the oxidation of fats of rainbow trout during frozen storage preventing rancidity. There is also a demand for all-natural astaxanthin to be incorporated into supplements. The increased need for astaxanthin in the commercial world requires new sources for the carotenoid. Previous research has developed methods for isolation of novel astaxanthins from algae (*Haematococcus pluvialis*) and lobster (*Homarus vulgaris*). The presented research was conducted in order to determine whether these techniques can yield similar samples of astaxanthin from the closely related crawfish, *Procambarus clarkii*. If similar methods are used for the control, *Homarus vulgaris*, and *Procambarus clarkii* then spectroscopic analysis will yield similar results for both species. Ultraviolet/visible spectroscopy showed absorbance at different wavelengths for the lobster and crawfish isolates. High performance liquid chromatography analysis yielded different peak retention times for the isolates. It was concluded that the techniques for astaxanthin isolation from lobster resulted in isolation of a different compound when applied to crawfish.

### **“The Effects of Carotenoids on Lung Cancer”**

Jocelyn Lostetter

Faculty Advisor: Dr. Rachel Rigsby, Ph.D.

Major: Biochemistry and Molecular Biology

Carotenoids play a vital role in the diet of humans because they have antioxidant effects which make them key components to the human diet. The alternating single and double bonds of their polyene backbone allows them to absorb excess energy from other molecules protecting them from the effects of free radicals and singlet oxygen. Carotenoids antioxidant properties make them very important in the research of the treatment and prevention of cancer. In this research three different carotenoids, lycopene, lutein, and beta-carotene were extracted from plants and cultured with lung cancer cells. Lycopene was isolated from tomatoes and lutein and beta-carotene were isolated from kale and their concentrations were measured. High performance liquid chromatography and thin layer chromatography were used to identify the extracted carotenoids. The effects of the three carotenoids were investigated on a lung cancer cell line NCI-H69. NCI-H69 is a cell line that grows in aggregates and the number of aggregates and their approximate size were measured after being cultured with one of the carotenoids. Beta-carotene was found to enhance the growth as larger and more aggregates were found cultured with this carotenoid than with the control. There was a decrease in the size and number of aggregates with the cells cultured with lutein and lycopene. It was determined that beta-carotene may possibly enhance the growth and lutein and lycopene may hinder the growth of NCI-H69 cells.

### **“Estimation of the Effects of Hormone Treatments on the Bioavailability of Lutein”**

Alyssa Merkel

Faculty Advisor: Dr. Rachel Rigsby, Ph.D.

Major: Biochemistry and Molecular Biology

Lutein is a naturally occurring carotenoid found in green leafy vegetables. With its high antioxidant activity, lutein helps prevent the formation of harmful free radicals in the body. Although it is concentrated in the macula of the eye, the body does not naturally produce this carotenoid and it must be ingested from vegetables such as spinach and kale. In order to get the full health benefits of lutein, it is recommended to ingest about 10 mg of lutein per day. However, because it is very susceptible to oxidation and chemically unstable in the presence of an acid, after digestion there is little lutein left for absorption into cells. Previous research has shown a possible positive correlation between hormone levels and serum carotenoid activity. The purpose of this research was to investigate what effects hormone treatments have on the bioavailability of lutein from spinach. An *in vitro* digestion model was used to simulate the gastric and intestinal phase of metabolism and to determine what amount of lutein was available from the spinach after digestion. Differing concentrations of synthetic hormones, Progesterone and Ethisterone, were added during the digestion and the amount of lutein was quantified using HPLC analysis. The results show an increase in the amount of lutein available after the addition of hormones, but no significant difference in the concentrations of each hormone. This data may help determine a way for older women, who are more susceptible to eye disease, to increase lutein in their diet with these hormone treatments.

## **Mathematics**

### **“Figuring”**

Laurajeane Gerber and Rachel Cleveland

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Mathematics and Music Business

In Figuring, Shakuntala Devi explains many different patterns that exist in numbers and in basic mathematics. Using these methods can allow an individual to process numbers quickly and efficiently in any arithmetic circumstance. Proving how these

methods work will help us understand the characteristics of math and reduce the time it takes to solve simple systems of equations. This is important because it allows students, professionals, and small children to relate simple rules to even easier solutions. The idea of proving these methods is parallel to the logical reasoning process promoted through discrete math equations. Proving is important because it shows the truth-value of the theory, and allows you further to understand the answer and its validity. In order to complete this proof, we will start with a few basic ideas involving short cuts in addition, subtraction, multiplication, fractions, etc. Using these topics we will relate them to how it can help young and old comprehend the basics of math. We will have examples of simple short cut ways for each area along with a proof that shows how the method is true and should work every time. After all the research is complete, we will display a collaboration of information on magic numbers and how you can become your own calculator.

### **“Math Magic”**

Callie Goyer and Ashley Elrod

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Undecided

Math Magic is a series of eleven problems and puzzles that give the illusion of being magic, but in reality, all have mathematical explanations. These problems can be solved using direct proofs, logic, modular arithmetic, and other various forms of mathematical reasoning. All of these solutions are derived from topics found in discrete maths. The purpose of this project is to reveal the entertaining and interesting side of the mathematics field. The project and presentation are interactive, and both require the participation of the visitors at the SURS.

### **“Number of Possible Triangles That Can be Drawn in a Convex Polygon”**

Benjamin J Heacock

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Mathematics

Triangles can be drawn within a convex polygon using diagonals and sides. The total number of possible triangles can be found by a generated construction. First, the number of triangles formed by adjacent sides and one diagonal is  $s$  ( $s$  refers to the number of sides of a certain convex polygon). Add to  $s$  the number of triangles formed with one side of the polygon and two diagonals meeting at the same vertex, which can be written as:  $s(s-4)$ . Then, if applicable, add to this the number of triangles with sides that are composed solely of diagonals drawn between non-adjacent vertices, which can be written in terms of  $s$ :  $2(s-5) + (s-4)(s-6) + 2(s-7)$ . Then, if applicable, add the number of triangles with sides composed solely of diagonals inscribing at least two vertices, which can be written in terms of  $s$ :  $3(s-8) + (s-6)(s-9) + 3(s-10)$ . Note: all terms,  $(s-n) = \{(s-n) \text{ if } s > n; 0 \text{ if } s = n; 0 \text{ if } s < n; \text{ for all integers } n\}$ . The last set of terms for the construction of a convex polygon with  $s$  sides can be found using terms of  $v$ , where  $v = \lfloor s/3 \rfloor - 1$ . And each previous set of terms in the construction can be found with  $v-1, v-2, v-3$ , etc until  $v-p = 1$ . So, using this construction, the number of triangles that can be formed within a convex polygon with  $s$  sides can be found.

### **“Make Money with Discrete Probability: Which Game to Play?”**

Luke Horsley, Kelly Harlan, Stephanie Bobo

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Mathematics

This SURS poster project centers around two common game-playing problems: the Monty Hall problem, choosing which door out of three that has the prize behind it, and the game Roulette. The poster will explain in detail how the two different games work as well as give an explanation behind the probability of winning for each game.

### **“Probability in a NCAA Basketball Tournament Pool”**

Abby Leatherwood and Dawn Thoni

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Mathematics

Once a year, the NCAA college basketball tournament takes place and thousands of people fill out a bracket by selecting who they think will win each game. In this problem, the number of all the different pairings of one team with another was found. The probability of someone winning the pool by picking the winners of all the games was also figured by listing the different outcomes of each game by using a specific method. Patterns and combinations were found for each point which eventually led to an answer.

## **“Gödel’s Incompleteness Theorems: the Proof, its Implications, and its Limits”**

Matthew Lefavor, Steve Corrao

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Mathematics

Gödel’s Incompleteness Theorems state that, for any consistent formal system  $S$ , if it is possible to do a certain amount of basic mathematics within  $S$ , then  $S$  cannot prove its own consistency, and  $S$  is incomplete—that is, there exist statements of such mathematics which  $S$  can neither prove nor disprove. The logic that underlies these proofs is somewhat difficult; in our project, we will explain the proof and its logic, and attempt to illuminate its somewhat dry logic through the use of analogy. We will briefly discuss the implications of Gödel’s theorems on number theory and mathematics, and also discuss the equally important question of what Gödel’s theorems do **not** imply, as it is frequently misused in support of things well beyond the scope of formal systems or even mathematics itself.

## **“RSA Public Key Encryption”**

Jordan Williams and Jared Burke

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Computer Science

The RSA algorithm was invented by Ronald L. Rivest, Adi Shamir, and Leonard Adleman in 1977. Today it is found on millions of computers and is used in most online encryptions. Although RSA is extremely secure, there are several theoretical ways the security could be compromised, including factorization of the seed numbers used for encryption. We will create a program that will use the latest advancements in processing architecture to more efficiently execute some of these theories.

## **“Theory of Games: Behold Your Future”**

Robbie Woolsey, Matt Feury, and Jacob Madden

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Economics, Audio Engineering Technology, Mathematics

Game Theory is a branch of mathematics that has relevance in multiple areas. For example, economics, biology and political science all use game theory to predict certain behaviors and outcomes for different situations. We will be presenting game theory in the realm of gambling. More specifically we will be focusing on the game theory implications in the games of Poker and Blackjack.

## **Physics**

### **“An Examination of Temperament”**

Dustin Martin, Taylor Grubbs, Cory Goff

Faculty Advisor: Scott H. Hawley, Ph.D.

Major: Audio Engineering Technology

For hundreds of years the question of temperament and tonality has been of concern to both musicians and instrument makers. Modern instruments are designed according to the 12-tone equal temperament system. This system allows for better playability among ensembles but sacrifices precise tonality. We will be analyzing temperament and comparing different systems that attempt to compensate for imperfection in tonality.

### **“Microphone Placement on Snare Drum Based on Resonant Frequencies and Chladni Patterns”**

Scott Songer, Joe Reinders, Matt Hamilton, Elliot Wiley

Faculty Advisor: Scott H. Hawley, Ph.D.

Major: Audio Engineering Technology

By running a sine wave generator through an amplifier and placing it under a drum covered in sand we will find several resonant frequencies that create concentric circles on the drum head. Then to determine the best microphone placement on the drum head we will examine the Chladni pattern while the drum is being driven by resonant frequencies. Wherever the sand does not gather in concentric circles corresponds to an antinode or area of great displacement, so we would want to place the microphone there to obtain an optimum source signal

# Psychology

## **“Figure-Ground Discrimination and Conceptual Suggestion”**

Rachel Allen, Ben Bryan, Katie Godwin, Jake Shane

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Honors

Ambiguous images are created when two objects are imbedded in one another. People tend first to see a particular object as the figure and the rest of the image as a background, sometimes later discovering that there is another object in the image which might also be understood as the figure. The process of making this distinction is figure-ground discrimination. Many past studies of figure-ground discrimination have focused primarily on ambiguous images themselves and what makes a particular object stand out as figure in an image. This study examines instead the person doing the discriminating to see if previous experience with images could affect which of two objects in an image is viewed as a figure. We showed 16 Belmont students a series of images prior to their viewing of an ambiguous image. Control groups viewed a series of unrelated images, while other groups viewed a series of images which contained images of objects similar to one of the objects in the ambiguous figure. We expected that the groups whose image series contained images related to one of the objects in the ambiguous image would be more likely to identify this object as the figure.

## **“The Effects of Attention on Motion-Induced Blindness”**

Austin Atwood, Ben Heacock, Kelsey McMinn

Faculty Advisor: Lonnie Yandell Ph.D.

Major: Honors

Motion-induced blindness (MIB) occurs when target points are placed over a rotating background. As subjects stare at the center of an MIB display, the target points fade in and out of awareness in a seemingly random fashion. We hope to address the effects of eye blinking on the awareness of target points. We hope to discover whether eye blinking reduces MIB and whether awareness of blinking also makes a difference. Fifteen Belmont students will be randomly split into three groups. Members of all three groups will be asked to report which target points they are or are not aware of by pressing keys on a keyboard. The first group, the control group, will not be told that we are monitoring their blinking, with the hope that subjects from the first group will remain unaware of their blinking. Subjects from the second group will be told to blink as little as possible so that they will be aware of their blinking. This will help us determine whether or not conscious blinking has a different effect from nonconscious blinking on MIB. The third group will be asked to freely blink. This will tell us if frequent conscious blinking has different effects on MIB. All subjects will go through a practice run for 30 seconds and then a 3-minute session from which we will obtain our results. We hypothesize that while blinking is not solely responsible for the re-awareness of target points, blinking, especially voluntary blinking will reduce MIB.

## **“The Effects of Achromatic Inversion on Illusory Contours”**

Shirah Foy, Michaela MacDonald, Elizabeth Stewart

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Honors

Illusory contours are a type of visual illusion in which a monochrome contour can be perceived. The purpose of this study is to provide an analysis of depth perception as it relates to achromatic inversion, the substitution of black images for white and white images for black. Eighteen Belmont University undergraduate students, six males and twelve females, will individually view a total of eight images in a random order for three seconds each: four black-and-white contour illusions and each of their corresponding achromatic inversions. In between each image, participants will view a neutral slide for one minute. Participants will be asked to write down the first thing they see. It is expected that the traditional black-on-white illusory contours will be more easily perceived than their achromatically inverted counterparts.

## **“How Do Students Manage the Behavior of Professors”**

Rachael Haney and Laura Muck

Faculty Advisor: Peter Giordano, Ph.D.

Major: Psychology/Biology

The college classroom consists of complex patterns of student-faculty interaction. Professors attempt to create interest and motivate students to do well; students may attempt to influence or manage the behavior of professors by asking them, for example, to move assignment dates or lighten up the reading load. The purpose to this study was to develop a new self-report instrument to measure the beliefs and behaviors of students related to how they attempt to manage professor behavior. We hypothesized that this new measure would demonstrate adequate internal reliability and would be positively related to a grade orientation and negatively related to learning orientation among students (Eison, 1981). Fifty-eight (41 men, 16 women, one did not report gender) students enrolled in Introduction to Psychological Science participated in the study. The Classroom Behavior

Questionnaire (CBQ) consists of 24 Likert type items, 12 measuring beliefs related to managing professors and 12 assessing behaviors. The LOGO II consists of 32 Likert type items, 16 measuring grade orientation and 16 measuring learning orientation. Scales were administered in counterbalanced order and the procedure took approximately 20 minutes to complete. As predicted, the CBQ showed adequate internal consistency as measured by coefficient alpha. However, none of the correlations between the CBQ and LOGO II were statistically significant, as we had predicted. Interestingly, the belief portion and the behavior portion of the CBQ were unrelated to each other.

### **“The Effects of Color on Perception of Ambiguous Figures”**

Lauren Ivey, Krystal Long, Alex Margol, and Kyara Rafferty

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Honors

An ambiguous figure is an image which can be interpreted in more than one way. The images are created so that the viewer typically favors one interpretation over the other. Factors such as shape or direction have been proposed to explain why people first see one image over the other in ambiguous figures. Our experiment measured the effects of color on interpretation of these ambiguous figures. Participants were sixteen students ages 18-21 at Belmont University. Participants were shown a sequence of 10 images, with the first half either in black and then color or the first half in color first and then black. Participants wrote down the image they saw first. We expected the results to show that certain images would be seen first more in color. We hoped that the colored images would produce different results than the black and white images. Potential improvements in experimental design will be discussed.

### **“The Effects of Stereogram Experience on Stereogram Perception”**

Katherine F. Richardson, Sarah D. Simpkins, Alyssa O. Thanasack

Faculty Advisor: Lonnie Yandell, Ph.D.

Psychology

Majors: International Business, Music Business,

Stereo vision is the ability to see three dimensionally. It occurs through binocular disparity, which is a difference in two image locations of an object seen by both left and right eye and their processing in the retinas. It is thought to be useful in a multitude of tasks requiring coordination and depth perception, such as driving or throwing a ball. The current study sought to explain if stereoscopic vision is affected over time--whether it is easier, harder, or made no difference in stereo vision over a progression of random dot stereogram images. Sixteen Belmont students were presented with five random dot stereograms and given a two minute time limit to complete the task of identifying when the image became three dimensional to them. When each participant saw the three dimensional image, they were advised to alert his or her proctor, who was timing the amount of time it took to see the image in 3D. It was hypothesized that the participants would perceive depth more quickly when viewing the stereogram in 3D as they viewed an increasing number of stereograms. Whether the results will warrant further research in this issue will be discussed.

### **“The Effect of Audio or Visual Experience on the McGurk Effect”**

Pomai Verzon, Nathan Lee, Jena Rickards

Faculty Advisor: Lonnie Yandell Ph. D.

Major: Political Science, Theater, Music Business

Studies have shown that visual cues greatly influence audio comprehension for the average person. Pertaining to speech, the McGurk Effect is an illusion where perception of a short sound is altered when the mouth movement is different than the sound of the voice. This study tests if presenting the audio before the McGurk movie has a different effect than presenting the video before the McGurk movie. Fifteen Belmont students were randomly divided into four groups and presented with one of two McGurk movies ten seconds long repeating specific consonants. Group one heard an audio segment of movie one and then saw the entire McGurk movie one. Group two saw the video only of movie two and then saw the entire McGurk movie two. Group three heard an audio segment of movie two and then saw the entire McGurk movie two. Group four saw the video only of movie one and then saw the entire McGurk movie one. We expect that the groups who saw the video only before the McGurk movie would be more likely to experience the McGurk effect than those who only heard an audio segment before the McGurk movie. The effects of top down processing on speech perception will be discussed.

# ORAL PRESENTATIONS

## Beaman A

6:15 – 7:45

Dr. Pete Giordano, Moderator

6:15 – 6:30

### **“Exposure to Sex Stereotyped Video Game Characters and Physiological Desensitization to Sexual Harassment”**

Whitney M. Marvel

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Over the past three decades the video game industry has evolved and is a source of entertainment for many users. There are some images and behaviors presented in video games that can subconsciously shape users' perceptions. Dill, Brown, and Collins (2008) found that exposure to images of sex-typed video game characters result in greater tolerance of sexual harassment. Since it has been found that video game violence can physiologically desensitize users to real life violence (Carnegey, Anderson & Bushman, 2006), that same idea was applied to the desensitization of sexual harassment. This study recruited twenty male Belmont University student volunteers. Each participant's heart rate and galvanic skin response was recorded using a Biopac MP35 unit during an initial five minute baseline period, for an additional five minute baseline period after ten minutes of playing a video game, and during a five minute video that showed sexual harassment scenarios. It is expected that physiological desensitization will be evident in those participants who played video games containing sex-stereotyped characters.

6:30 – 6:45

### **“Personal Space on the Elevator”**

Jessica J Howard

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Personal space is essential to most of us, and when we feel our space has been invaded a multitude of reactions can occur, often times including undesirable ones. In this study 100 Belmont University male and female students were observed at various times in an elevator. The average length of time each student was observed was two minutes also observed was their behavior, in particular the interaction amongst males. The behaviors observed included any interaction, such as touching, speaking, avoiding and other noticeable forms of body language which might suggest comfort level. The results of this study are expected to show that males are more comfortable amongst females than amongst one another and will give insight to the behaviors of college males.

6:45 – 7:00

### **“Relationships between Adult Attachment Style and Desired Characteristics of a Potential Partner”**

Anna Claire Bowen

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Attachment theory was originally conceived by Bowlby (Bowlby, 1979) and his work with infant-caregiver relationships. With further research, the relationship that was once seen as a function between a mother and child has now been adapted to intimate relationships (Hanz and Shaver, 1987). The purpose of this study is to discover if there is a relationship between adult attachment styles and the desired characteristics of a potential partner. Sixty Belmont undergraduate students were asked to complete two surveys that would categorize them into a specific style of attachment (Fraley, Waller, and Brennan, 2000) and look at the characteristics that the participant finds attractive in a potential intimate partner (Pelham & Swann, 1989). It was expected that the participants that were categorized as secure would report to have more similar characteristics between the opposite-sex parent and that of their ideal partner. This information is needed to help understand intimate relationship dynamics and perhaps help those that have problems with attachment.

**7:00 – 7:15**

**“Autistic Tendencies and the Ability to Infer Emotion from Facial Expressions”**

Jessica L. Heacock

Faculty Advisor: Dr. Lonnie Yandell

Major: Psychology

Research suggests that individuals high on the Autism Spectrum have difficulty in social situations because they process nonverbal cues in either a different or impaired way compared to the general population. Because Autism disorders function on a spectrum and autistic tendencies can be found in typically developing populations it was hypothesized that the more autistic tendencies an individual displayed the more difficulty they would have with perceiving emotion based on visual cues. Sixty Belmont students were given the “Reading the Mind in the Eyes” test (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), in which they viewed pictures of thirty-six pairs of eyes and then had to choose from four adjectives for each pair of eyes that best described what that person was thinking or feeling. They were also given the Autism Quotient test (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), fifty Likert-type questions designed to measure autistic tendencies in both individuals with Autism Spectrum disorders and typically developing individuals. Results from the two tests will be analyzed to see if there is a correlation between scores. It is expected that there will be a negative relationship between the “Reading the Eyes in the Mind” test and the Autism Quotient test.

**7:15 – 7:30**

**“Happy and Sad Music’s Effect on Food Consumption”**

Johnny Beach

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Music can change our psychological moods. Music can improve our mood or influence our mood to decline. When up tempo or happy music is played cardiovascular and physiological activity increases and when lower tempo music is played, or sad music, cardiovascular and physiological activity decreases. A person is more active when cardiovascular activity is more stimulated and needs to consume more energy to stay at that level of activity. Therefore, when a person is listening to high tempo, energetic, or happy music a person would seem to need to consume more food. It was hypothesized that happy music will influence people to consume more food than sad music would. Sixteen college students from Belmont University were tested to listen to high tempo music and low tempo music with popcorn and chips presented in front of them. The participants were given the Matching Accuracy Test (MAT, Aero & Weiner, 1983) that would not be analyzed. Three groups listened to either happy, sad or no music. Each type of music was composed of three different musical pieces played for 3 minutes. In total they listened to nine minutes of either happy or sad music. In order to validate their mood they were given an adjective checklist (Mayer & Gaschke, 1988) after the unrelated survey was completed. The happy music is expected to influence the participants to consume more food than the sad music. This research may help to understand factors that lead to eating disorders.

**7:30 – 7:45**

**“The Effect of an Athlete’s Race on Perceptions of Student-Athletes by College Students”**

Kevin Stone

Faculty Advisor: Michael Sullivan, Ph.D.

Major: Psychology

Many stereotypes surround college student-athletes in America. Previous research has shown that collegiate students in the general student body (non-athletes) have significantly more negative attitudes toward student-athletes than towards other students. The current study examined the effect of an athletes’ race on perceptions of student-athletes by various groups of college students. Collegiate athletes and non-student-athlete volunteers were asked to identify which sport a particular student-athlete participated in, based solely on a picture of the athlete. It was hypothesized that Black student-athletes would be more frequently identified with Revenue sports (basketball and football) and White student-athletes will be more identified with Olympic sports (swimming, volleyball, baseball). It was also expected that this effect would be greater for female than male athletes. General students and student-athlete participants responded differently based on the athletes race and gender. Student-athletes were more likely to identify a picture of a Black student-athlete as playing a stereotypical “Black sport” than non-athlete students. Both groups stereotyped Black student-athletes as playing Black sports more often than what the actual proportion of Black athletes in these sports indicates, according to analyses of racial participation across NCAA institutions.

# **Beaman B**

**6:15 – 7:30**

**Dr. Mary Goodloe, Moderator**

**6:15 – 6:30**

## **“SudokuSolver: Iterative Software Design in an Object-Oriented System”**

Nathan E. Davis

Faculty Advisor: Dr. Joyce B. Crowell, Ph.D.

Major: Honors, Computer Science

Software design is almost always an exercise in compromise. While there are many competing models, each has its own tradeoffs, whether it is trading structure for flexibility or speed for reliability. However, there is one particular design element that can be found in nearly all the design models proposed in the last two decades: iterative software development, or ISD. Based on the spiral model of software development originally proposed by Boehm in 1987, ISD departs from the traditional structure of the “waterfall” development model in favor of developing working prototypes that demonstrate parts of the overall system through iterations, and small changes are implemented in increments over time. Using this design philosophy, an example system called SudokuSolver, a program which creates and solves Sudoku puzzles, was created. This presentation will examine the advantages and disadvantages of using ISD in developing SudokuSolver as well as the challenges associated with implementing a solution to an NP-complete problem such as Sudoku.

**6:30 – 6:45**

## **“A VST Plug-in Implementing a Physical Model of Room Reverberation”**

Tyler Welton

Faculty Advisor: Scott H. Hawley, Ph.D.

Major: Audio Engineering Technology

We will apply the reverberation algorithm known as the Method of Images to calculate how sound reverberates in rooms of various sizes. These calculations will then be translated into a usable plug-in for DAWs (Digital Audio Workstations). This plug-in will be programmed using the C++ programming language. Its output will be a .dll file which is standard as a VST plug-in. From there it can be translated into a number of different formats for different software.

**6:45 – 7:00**

## **“Backbiting Hamiltonian Paths”**

Neil E Kowalewski

Faculty Advisor: Joan Lind, Ph.D.

Major: Mathematics

Researchers in statistical physics created a mathematical model in which they needed to generate random Hamiltonian paths on an  $n$  by  $n$  grid. To do so, they developed the method of backbiting to generate Hamiltonian paths. (See “Secondary Structures in Long Compact Polymers.”) Their work is not yet on a solid mathematical foundation as it has not been proved that the method of backbiting will yield every possible Hamiltonian path. To begin exploring this problem, we are developing a computer program that will backbite and then count the number of different paths that can be obtained in this way. To be able to determine whether the program was achieving the correct total number of possibilities for small  $n$ , we also did a hand count of all the possible Hamiltonian paths for a 3 by 3 grid and a 4 by 4 grid.

**7:00 – 7:15**

## **“Discovering the Curve-Creating Black Box”**

Cat Simpson, Sarah Claiborne, & Amy L. Valentine

Faculty Advisor: Joan R. Lind, Ph.D.

Major: Mathematics

The Belmont Undergraduate Research Student Team (BURST) is a group of undergraduate students who have been working on a research project this semester. In short, the group is studying the Loewner differential equation, which can be symbolized as a black box with functions as input and different curves as the output. The focus of the study has been to input both random and deterministic functions to see what the output may look like through computer generated pictures. One of our challenges has been to find input functions that give 'ugly' output curves. In particular, we would like to find input functions that will output a spiral or a space-filling curve.

**7:15 – 7:30**

**“Simulating Schramm-Loewner Evolution”**

Andrew B. Hill & Matthew C. Lefavor

Faculty Advisor: Joan Lind, Ph.D.

Major: Computer Science

Belmont University students had previously begun developing an application to simulate Schramm-Loewner Evolution, a method of generating random curves by solving the Loewner differential equation using Brownian motion as input. Several features were corrected and improved, and many new features have been implemented. The application now simulates Brownian motion much more accurately and generates the correct curves for deterministic function input. It can “refine” function data by inserting appropriate points between two simulated points, and initially “scale” data to generate functions with much more precise endpoint behavior.

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