



**Third Annual  
Science Undergraduate  
Research Symposium**

**Thursday, November 30, 2006**

**KEYNOTE ADDRESS**

**“Wiring The *C. Elegans* Motor Circuit:  
Turning Off the Wrong Genes To Make The Right Connections”**

**Dr. David Miller**

**Department of Cell and Developmental Biology**

**Vanderbilt University**

**3:00 PM**

**RECEPTION & STUDENT POSTER SESSION**

**4:00 – 5:00 PM**

**STUDENT ORAL PRESENTATIONS**

**(Simultaneous sessions)**

**5:00 – 6:45 PM**

# POSTER SESSION

Beaman Lobby

4:00-5:00 PM

## Biology

### “Characterization of *Unc-49* Mutant *C. elegans* Using Image Capture and Analysis”

Stacey Apple

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

This study utilized the nematode *Caenorhabditis elegans* (*C. elegans*) to investigate movement deficits. *C. elegans* is a powerful model system for exploring neuroscience. *C. elegans* have 302 neurons, representing about 30% of the total number of 959 somatic cells. The *C. elegans* genome has been sequenced and published on the NCBI website. In addition, a number of characterized mutations are available upon request from the *Caenorhabditis* Genetics Center (CGC). We obtained *C. elegans unc-49* mutants and N2 wildtype strains from the CGC for our experiments. *Unc-49* mutations were initially characterized as displaying a “shrinker” phenotype. These worms have a mutation in GABA receptors which are found on inhibitory interneurons. This results in loss of inhibition of antagonistic body wall muscles – the shrinker phenotype.

In collaboration with the computer science department, we have used image capture and analysis to evaluate movement deficits in *C. elegans unc-49* mutants. Following characterization of N2 and *unc-49* animals, we treated the nematodes with muscimol (a GABA receptor agonist) and  $\beta$ -alanine (a GABA transporter blocker) and evaluated the efficacy of these agents to restore wildtype function. The untreated *unc-49* mutant worms showed statistically significant differences in length when compared to N2 worms. Following treatment with muscimol, the *unc-49* mutants showed a significant increase in length. Mean velocity in the treated and untreated *unc-49* animals was also determined and compared to N2 animals, but no significant differences were noted.

### “The Study of the Heredity Of Parkinson’s Disease in *Caenorhabditis elegans*”

Kelly Deweese

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

*C. elegans* has become a desirable model system for scientific study. There are many advantages to using this organism in a laboratory setting, including its small size, short life cycle, and large brood size (1). Many of the biological pathways of *C. elegans* are highly conserved with those of human systems. Due to remarkable similarities, the nervous system of *C. elegans* is highly useful for studying many neurological diseases that afflict humans. Parkinson’s disease (PD), a complex neurodegenerative disorder, is characterized by the death of dopamine neurons in the brain (2). Wild-type *C. elegans*, when treated with a specific environmental toxin, will present Parkinson’s-like symptoms (1). This environmentally induced form of PD can be used in a variety of ways to study the mechanisms of this debilitating disease. One aspect of PD that will be investigated in this experiment is whether environmentally induced PD can be inherited by offspring. The resulting generation of *C. elegans* will then be assessed for certain behaviors, and this data will be compared to behavioral standards of wild-type worms. The results of this experiment will offer insight into whether environmentally induced PD can be passed down to offspring. In this study, we found a significant increase in the point velocity and mean velocity in treated versus untreated worms.

### “Studying Cellular Respiration Utilizing *Caenorhabditis elegans*”

Ashley Dozier

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

Cellular respiration is commonly explored in both lecture and laboratory exercises of the biology courses offered to majors. Students confuse much of the lecture material due to the abstract nature of the molecular interactions. Lecturers attempt to alleviate the confusion through laboratory exercise reinforcement. Currently, many of these laboratory exercises require the utilization of test organisms that either do not help solidify the cellular respiration concepts and/or that require the use of

expensive equipment. The purpose of this study was to determine the effectiveness of *Caenorhabditis elegans* as a model organism for the study of cellular respiration. Vernier™ software and transducers were Vernier™ software and transducers. Results indicate that *C. elegans* is an easy and inexpensive organism to demonstrate cellular respiration.

### **“Correlation Between Estrogen Levels and Knee Injuries in Female Athletes”**

Michelle Engberg

Faculty Advisor: Jennifer Thomas, Ph.D.

Major: Exercise Biology

### **“To What Extent Do SREBP’s Inhibit Foxc2 from Binding to IRS-2 Promoter Regions?”**

Trevor Holland

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

Insulin plays a major role in the anabolic effects associated with carbohydrate and lipid metabolism. The roles of insulin signaling in the liver include activation of glycogen synthesis for energy storage and suppression of hepatic glucose output. Gene targeting experiments have demonstrated that hepatic insulin signaling for these effects is mediated primarily through a protein called Insulin Receptor Substrate 2 (IRS-2), which regulates insulin sensitivity. Decreased *IRS-2* expression has been reported in the livers of animal models for insulin resistance. Further studies have led to the hypothesis that hepatic insulin resistance is mediated through inhibition of *IRS-2*. A family of transcription factors present in liver cells, the sterol regulatory element binding proteins (SREBPs), can inhibit *IRS-2* mediated signaling in the liver. A separate protein, Foxc2, a *forkhead box* protein responsible for promoting genes involved in varying stages of embryonic development, has been shown to promote the transcription of *IRS-2*. SREBPs have been shown to interfere with the binding of forkhead proteins, such as Foxc2. This project will address to what extent SREBPs inhibit Foxc2 from promoting the transcription of *IRS-2*. This will be done by transfecting cultured endothelial cells and performing a luciferase assay to determine transcription levels. Relative luciferase activity is indicative of the amount of transcription the reporter gene, in this case *IRS-2*, has undergone. In this way the amount of *IRS-2* transcription can be monitored in the presence or absence of certain proteins, such as the SREBPs or Foxc2, to determine how these proteins influence the expression of *IRS-2* when coexpressed in the same cell.

### **“Effects of Aircraft De-Icer Runoff into Sims Branch of Mill Creek in Davidson County”**

Andrew Kim

Faculty Advisor: Steven Murphree, Ph.D.

Major: Biology

Runoff from the Nashville Metropolitan Airport enters nearby bodies of water and can have negative impacts on the environment and the organisms that inhabit that environment. One chemical airports use commonly is de-icing fluid. This chemical is used in winter months when aircraft wings become covered by ice and is similar to antifreeze found in automobiles. It is composed mainly of ethylene or propylene glycol, which can have harmful effects on aquatic organisms because of their high biological oxygen demand. Ethylene glycol is toxic to mammals including humans. It can cause various health problems including neurological, cardiovascular and gastrointestinal problems. The Nashville Metropolitan Airport de-ices its aircraft at the terminals. They have a drainage system in place to minimize harmful chemical runoff into nearby bodies of water. After the fluid is collected, it is processed and released into the streams surrounding the airport; one release point is the Sims branch of the Mill Creek, north of the airport. This stream is currently listed by the Water Pollution Control of Nashville as polluted or impaired. One of the main causes of the pollution seems to be airport runoff. During winter months when de-icing fluid is employed, the Sims branch may be negatively impacted despite the system the airport uses.

### **“The Role of Tbx1 in Palate Development in Embryonic Mice”**

Amy Law

Faculty Advisor: Steven Goudy, MD

Major: Biology

Deletion of a portion of chromosome 22 in humans leads to a syndrome known as DiGeorge syndrome that is characterized by craniofacial and cardiac anomalies. The deleted portion of chromosome 22 in affected individuals contains, in normal individuals, the gene *TBX1* (1). *TBX1* is known to be a major contributor in some of the abnormalities associated with DiGeorge syndrome patients. In mice, absence of *Tbx1* leads to craniofacial and cardiac variances that are similar to those

observed in DiGeorge syndrome patients (2). In this study, the role of *Tbx1* in palate development is further examined through *in situ* hybridization, quantitative PCR, and staining for the occurrence of apoptosis and proliferation in the palate shelves of embryonic mice.

### **“Effects of Chronic Iron Exposure on Locomotion in *Caenorhabditis elegans*”**

Adam Militana

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

Neuronal metabolic dysfunction is thought to make dopaminergic neurons in the substantia nigra of humans particularly susceptible to oxidative stress, which elevates the neurotoxic effects of heavy metals. The loss of these neurons is ultimately responsible for the pathophysiology of Parkinson’s disease. Therefore, an understanding of this neurotoxicity could facilitate understanding of Parkinson’s disease.

*C. elegans* are useful as a model system for studies in neuroscience. *C. elegans* have a relatively simple neural anatomy consisting of three hundred neurons whose morphological connections have been described. Additionally, the nematode utilizes many of the same neurotransmitters that humans do including dopamine, serotonin, and glutamate. These qualities give a broader significance to study of the nematode’s neuronal system. The nematode has 8 dopaminergic (DA) neurons of which two are associated with body wall muscles such that loss of these neurons results in changes in locomotion.

Our goals were to demonstrate that chronic iron exposure causes changes in locomotion and that these changes are due to the loss of dopaminergic neurons. Mean velocities of treated and untreated animals were determined using image capture and analysis. Immunoblotting was then used to evaluate relative levels of tyrosine hydroxylase (TH) in the worms. Our results show significant changes in locomotion but we were unable to detect changes in TH levels. Future studies may use PCR to assess changes in mRNA for TH or worms in which GFP is expressed in DA neurons, so that decreased fluorescence following treatment would suggest loss of DA neurons.

### **“Alcohol’s Effect on Stress in *C. elegans*”**

Esther C. Moon

Faculty Advisor: Nicholas Ragsdale, Ph.D.

Major: Biology

Using *C. elegans* as the model system, the affects of ethanol consumption on stress behavior will be investigated. The *C. elegans* will be placed under heat stress and then their stress response will be measured. There is a control group and a treated group that is exposed to ethanol after stress. A migratory index will be observed and data will be collected. The results will be that both groups portray the same stress responses or that the ethanol group will portray a different response. If the responses are the same, the conclusions will be that ethanol has no effect on stress levels. If the responses are different, the conclusions will be that ethanol has an effect on stress levels.

### **“The Effects of UV Light on the Mobility of *Caenorhabditis elegans*”**

Michel Mosby

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

Ultraviolet light has been known for having serious effects on the skin of humans. Although UV light has different wavelengths, the basic ones being UVA, UVB, and UVC, each kind of wavelength can cause the same, or similar, problems with human skin. This type of light can cause rapid skin aging and, most commonly, skin cancer. UV light causes skin cancer by damaging DNA, which in turn may cause the over-production of skin cells. These skin cells may eventually, if produced in an elevated amount, turn into cancer cells. If ultraviolet light can produce problems in the DNA of humans, how can the wavelengths from this kind of light effect a simple organism such as *Caenorhabditis elegans*? *C. elegans*, because of its nervous system similarity to that of human beings, its small genome, and definite number of cells, has been used in numerous experiments to better understand various types of human function. This experiment set out to determine how the effects of ultraviolet light exposure to *C. elegans* could cause different problems, specifically speaking in the realms of organism mobility.

## **“Refining the Chemotaxis Assay in the Nematode *Caenorhabditis elegans*”**

Rebecca Repasky

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

*Caenorhabditis elegans* (*C. elegans*) are useful as a model system for studies in neuroscience. *C. elegans* have a relatively simple nervous system consisting of about three hundred neurons representing about 30% of their 959 somatic cells. These neurons have been studied and characterized according to lineage and neural connections. Additionally, the nematode's neurons utilize many of the same neurotransmitters that are present in humans including dopamine, serotonin, and glutamate. Chemotaxis experiments provide an excellent way to assess neural function by observing the worm's responsiveness and movement toward or away from a chemical gradient.

In order to refine our ability to assess chemotaxis in the worm *C. elegans*, I performed chemotaxis tests utilizing three different chemicals, consisting of two attractants, iso-amyl alcohol and butanol, and one repellent, benzaldehyde. Data from these experiments was also compared to previous tests to assess reproducibility of the assay. Using the standard protocol for chemotaxis experiments with a few modifications, I found results consistent with previous papers, albeit still slightly lower in most cases. The primary modification made to the previous protocol was a reduction in the concentration of sodium azide used to immobilize the worms. This was an important finding because too much sodium azide may result in inappropriately low chemotaxis indices.

## **“The Effects of Caffeine on Locomotion and Chemotaxis in *Caenorhabditis elegans*”**

Trisha Siewnarine

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

Caffeine is one of the most commonly used addictive substances among humans. During the last few decades there has been speculation about how caffeine affects humans. Acute and long-term exposure to caffeine, results in desensitization to endogenous neurotransmitters because it damages receptors in the body. Caffeine affects a number of neural pathways in humans, and this complexity makes it difficult to determine the exact mechanism of action. *C. elegans* are a simple model system that makes examining neurological pathways easier and demonstrates similarity to the neurological pathways in humans and other animals. In addition, a number of characterized strains are available upon request from the *Caenorhabditis* Genetics Center (CGC). We obtained *C. elegans* N2 wildtype worms from the CGC for our experiments. Previous studies have demonstrated that caffeine works as an adenosine receptor antagonist and inhibits its ability to bind to adenosine, thereby affecting adenosine-modulated serotonin release. Based upon this work and on the role of adenosine in *C. elegans*, we predicted that caffeine would affect locomotion and chemotaxis in the nematodes. We used image capture and analysis software to determine mean velocities in N2 worms treated with caffeine and compared them to untreated controls. Our results suggest that both acute and long-term exposure to caffeine decreases locomotion in *C. elegans*. We also determined chemotaxis indices for treated and untreated *C. elegans* and found a dose-dependent decrease in chemotaxis toward iso-amyl alcohol in the caffeine-treated worms. Further studies could provide insight into mechanisms of addiction and possible treatments.

## **“Protein Refolding and Aggregation in Neural Cells: Evaluating the Role of the Chaperone Associated Protein CHIP”**

Channing Twyner

Faculty/Grad Student Advisors: Jeannette Stankowski & BethAnn McLaughlin

Major: Biochemistry and Molecular Biology

Heat shock proteins are molecular chaperones that have the ability to renature misfolded proteins as well as target them for degradation via the ubiquitin proteasome pathway. Protein aggregates have been observed in neurological disorders and show substantial levels of ubiquitin, suggesting that aberrant folding and trafficking may contribute to cell death. Carboxy terminus of Hsp/Hsc 70 interacting protein (CHIP) plays a role in protein quality control, acting as link between molecular chaperones and the ubiquitin proteasome pathway. Here we induce thermal and oxidative stress to HT22 cells and HT22 cells with altered CHIP expression and evaluate protein renaturation activity, proteasome activity, and ubiquitinated protein levels. We report that HT22 cells that express CHIP which is lacking its ubiquitin ligase domain have increase protein folding activity compared to wild type control after mild heat shock (HS), but this affect is not observed with longer HS. We observed a decrease in refolding activity after heat shock in HT22 cells that overexpress full length (FL) CHIP compared to wild type suggesting that CHIP is trafficking denatured proteins to the proteasome. We also report a decrease

in proteasome activity after oxidative stress in HT22 cells that overexpress FL CHIP along with an increase in compare to wild. Surprisingly, we report a lower level of ubiquitinated protein in HT22 cells that overexpress CHIP as compared to wild type after heat shock. Since FL CHIP is expressed abundantly in brain regions subject to neurodegeneration and stroke, we believe that it may be a viable target to alter protein aggregate pathology.

### **“*Caenorhabditis elegans* as a Model for Nicotine Addiction”**

M. Corey Winfree

Faculty Advisor: Lori McGrew, Ph.D.

Major: Biology

The National Institute of Medicine reports that nicotine is the most addictive substance known to mankind. Nicotine binds to endogenous receptors which are present in the nervous systems of vertebrates and invertebrates, and its use has been linked to a number of diseases. Treatments for nicotine addiction thus represent an important field of research. This study explored the nematode *C. elegans* as a model system for nicotine. Because of their simplicity both in anatomy and behavior, *C. elegans* have long been used as a model system in genetics, development and neuroscience. The *C. elegans* genome has been sequenced and published. In addition, a number of characterized strains are available upon request from the *Caenorhabditis* Genetics Center (CGC). In collaboration with the computer science department, we have used image capture and analysis to evaluate body length and locomotion in *C. elegans*. Following characterization of control animals, we treated the nematodes with increasing concentrations of nicotine and evaluated the effect on body length, locomotion and chemotaxis. Half of the worms were also treated with neostigmine, a partial agonist for nicotinic cholinergic (nACh) receptors. Our hypothesis was that a partial agonist could provide treatment for the symptoms of nicotine withdrawal without causing desensitization of nACh receptors. Our data suggest that nicotine causes a dose-dependent decrease in body length which is consistent with previous reports. We also found that nicotine withdrawal caused a decrease in mean velocity. Neostigmine treatment was not able to restore wildtype locomotion. Future studies are planned to explore effects on egg-laying.

### **“Role of the Dopaminergic System in Response to Chronic Ethanol Exposure in *Caenorhabditis elegans*”**

Evan Witherington

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

In this study, *C. elegans* were used to examine the effects of chronic ethanol treatment. *C. elegans* provide an ideal model system because of their simple nervous system and quick reproduction. Previous studies have indicated that ethanol plays a role in drug addiction, reward response, and locomotion. This experiment extends prior work in these areas and primarily investigates the role of ethanol in the dopaminergic system of *C. elegans*. *C. elegans* strains tested include wild-type and variations of Dop-1, Dop-2, and Dop-3 knockouts. The worms were chronically exposed to ethanol for four days followed by a detoxification day. A chemotaxis assay was performed on the fifth day. At this time, no addiction patterns have been seen in the experimental data. However, ethanol has shown an effect on the chemotaxis indexes.

## **Chemistry**

### **“Chemical Combinations For Curing Of Marine Mussel Adhesives”**

Lauren Hight

Faculty Advisor: Alison Moore, Ph.D.

Major: Professional Chemistry

The common blue mussel produces and cross-links a protein based adhesive to affix itself to a surface. These proteins contain the unusual amino acid 3,4-dihydroxyphenylalanine (DOPA) which is believed to be the site of cross-linking. Previous research has found that transition metal ions and non-metal oxidants bring about optimum curing of the adhesive. To investigate the possibility of a synergistic effect on cross-linking between metals (e.g.  $\text{Fe}^{3+}$ ,  $\text{Cr}_2\text{O}_7^{2-}$ ) and non-metal oxidants (e.g.  $\text{H}_2\text{O}_2$ ,  $\text{IO}_4^-$ ), we performed a study in which extracted protein precursor was cured with a variety of transition metal and simple oxidant combinations. The results show increased levels of curing when certain combinations of metals and oxidants are used to cross-link the adhesive (e.g.  $\text{Fe}^{3+}$  and  $\text{IO}_4^-$ ). We conclude that blue mussels may incorporate the synergistic effects of transition metals and simple oxidants for protein cross-linking and adhesive curing.

## **“Caffeine Determination of Folgers, Maxwell House, and Starbucks Coffee by UV: Does Preparation Change the Amount of Caffeine Present?”**

Kelly O. Major

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

Major: Chemistry

Caffeine is an alkaloid found in numerous plants, where it acts as a natural pesticide that paralyzes and kills insects that try and consume the plant. In humans, caffeine acts as an adenosine receptor antagonist in the brain resulting in an increase of dopamine. This increase causes the stimulatory effects of caffeine. The most common plants containing caffeine are coffee, tea, and cocoa. Caffeine content varies widely depending on coffee bean type, brewing method, and grind. On average, one serving of coffee contains 40-100 mg of caffeine. Ultra-Violet spectroscopy will be used to determine the amount of caffeine present in one serving of both regular and decaf coffee in Maxwell House, Folgers, and Starbucks. Two different methods, auto-drip and French press, will be compared to determine if the brewing method increases the amount of caffeine per serving. It is expected that more caffeine will be present in coffee brewed via the French press.

## **Mathematics**

### **“Graph Theory, Hypercubes, and Parallel Computing”**

Chris G. Bishop

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Computer Science

Graph Theory is the study of graphs and the objects' relationships the graph models. The term graph used here is meant to be a mathematical structure, or a data structure. An example of this can be visualized by thinking of two dots and a line connecting them. The two dots are the objects and the line is the relationship between them. Geometric Graph Theory is a specialized sub-field within Graph Theory where the dots, or vertices, are now represented by geometric configurations. A Hypercube is an example of a geometric graph where four relationships can be connected to each object, or vertex, within the structure of the four-dimensional cube, or hypercube. The usefulness of the hypercube can be seen in the construction of a specific parallel computer. This certain parallel computer is a computer where multiple processors are arranged in the same pattern and relationships as that of the vertices within a hypercube. The main purpose of a parallel computer is to simultaneously distribute a task among several processors to achieve a faster result. Hypercubes are powerful tools in which complex structures can be modeled to provide an easier visualization of the end result and one of the reasons parallel computers are so prevalent in today's technological field.

### **“Modeling the Effects of an Asteroid Impact”**

Stuart Childs

Faculty Advisor: Stephen Campbell, Ph.D.

Major: Computer Science

Earth's geological history is punctuated with numerous impact events with asteroids. Due to the large mass and velocity of many asteroids, they have an incredible amount of potential energy which will cause wide scale destruction in the event of an impact. The devastation has the potential to threaten the ecosystem of the planet and the survival of many species, including humans. The two types of impacts of greatest concern are solid earth impacts and impacts with the oceans. A solid earth impact has serious direct effects and indirect effects. Firstly, the explosion will destroy everything within the blast radius and create an impact crater, both of which are primarily proportional to the diameter of the asteroid. Secondly, the earth moved to create the crater will be ejected from the surface and fill the atmosphere, eventually covering most or all of the Earth, blocking out the sunlight. In the event of an impact with the ocean, the explosion will instead displace a proportional amount of water, resulting in the creation of a tsunami. A tsunami generated by an asteroid impact has the potential to seriously threaten the often densely populated coastal areas in many parts of the world. Given this, it is helpful to have a model of the impact of an asteroid so that we can gauge the effects and properly prepare for the event when detected early.

## **“Algorithm Efficiency and Big-O Notation in Software Applications”**

Jon Davachi

Faculty Advisor: Sarah Stewart, Ph.D.

Major: Computer Science

Algorithm efficiency is the analysis of the relative effectiveness of functions. The application of this technique creates growth and maximizes potential. Performing duties effectively increases organization. This is especially important for companies, who can stand to lose significant amounts of time and money by operating inefficiently. Algorithm efficiency in computer software applications is utilized by software engineers to minimize the amount of memory used and time spent. Big-O notation is used to describe the runtime analysis of programs. Programs are described in  $O(n)$  notation. It is possible to write a program to do a function in a  $O(n^2)$  time and be rewritten to perform the same duty in  $O(n)$  time. It is important for programmers to recognize these opportunities and strive to design in the most efficient manner.

## **“Airport Simulation: A Study in Queueing Theory”**

Nathan Davis

Faculty Advisor: Stephen R. Campbell, Ph.D.

Major: Computer Science/Mathematics

Always waiting in long lines seems to be one of the prices we pay in modern society. However, long lines are not nearly as inevitable as they may seem; it is possible to use mathematics to optimize the efficiency of all service lines. More formally, service lines are called queues, and the branch of mathematics devoted to studying them is called queueing theory. Using an idealized simulation of a small airport, this project demonstrates some of the fundamentals of queueing theory, including Little’s Law and the Poisson Process. Additionally, it overviews the origins of queueing theory and illustrates the advantages and disadvantages of various queue designs and disciplines. Finally, there will be a brief examination of fields where queueing theory has proven useful, as well as where it shows promise in the future.

## **“Artificial Neural Networks and Character Recognition”**

Jacob A Eichenberger

Faculty Advisor: Stephen R. Campbell, Ph.D.

Major: Computer Science/Mathematics

Artificial Neural Networks provide a model of computer learning for simple tasks such as character or number recognition. More recently, artificial neural networks are being used to help detect pre-cancerous masses in breast tissue by analyzing films from MRIs and mammograms. A short example of some character and number recognition techniques will be demonstrated and a simple program will be provided that has some very basic learning capabilities.

## **“Problem Solving Using Combinatorics and Mathematical Induction”**

Jessica McMillian

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Engineering Physics/Political Science

Combinatorics is a branch of math that studies collections of objects and how they satisfy given criteria. This project will be looking at two problems involving combinatorics, one called “The Marriage Problem” and the other entitled “Marital Infidelity”, involving sets of objects. “The Marriage Problem” gives a set of conditions and requires the student to give stipulations in order for the set to reach a given outcome. The “Marital Infidelity” problem is a very interesting take on how to use mathematical induction in problem solving.

## **“Mathematics in AI”**

Brent M. Shaffer

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Commercial Music/ Music Technology Emphasis

Prolog, or **Programming Logic**, is a language based on logic rather than numeric values. It was invented in France in the 1970’s. The program is exemplified in Intelligent Systems, Expert Systems, Natural Language Systems, and Relational Database Systems. Specifically Natural Language Systems are designed to respond to normal language phrasing rather than to keywords. This opens into the fields of Multiple Qualifiers and Formal Logic Notation in Discrete Mathematics. Prolog also deals with Expert Systems, a type of system that replicates decision-making at the expert level using, among

others, abduction techniques. This type of Artificial Intelligence is usually attributed to the realm of Conventional AI, or Machine Learning, which is considered to have a heavy connection with Statistics. Mathematics are also involved in Computational Intelligence, which deals with developmental AI such as Evolutionary Computation. In short, Mathematics will be explored within Artificial Intelligence in its entirety, with a special emphasis on the language of Prolog.

### **“Finite State Automata-What They Are All About”**

Ryan A. Sharp

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Web Programming and Development

A finite state automaton is basically a machine that relies on input to change states that in turn affect subsequent inputs and how they're processed. A finite state automaton must include five elements: a set of input symbols called the “input alphabet”, a set of states the automaton can be in, an “initial state”, a set of “accepting states”, and a “next-state function” that calculates the next state by using the current state and the current input. The processes a finite state automaton runs through to work properly can be seen in a state-transition diagram. Judging from the initial state of the machine and the initial input (choosing from a designated set), the machine does exactly as it is told and calculates the next state. From there, the next state again depends on the current state and the current input. Once the machine has reached its' accepting state, it starts over again. Discrete math is reflected by the fact that it is the study of non-continuous mathematical elements and structures, and a finite state automaton is itself finite. There are no unknown factors or continuity involved because every process is based on previous knowledge and is predictable. Some finite state automata that are common in today's world are vending machines, telephones, and ticket machines.

### **“The Efficiency of Commonly Employed Algorithms”**

Ben Stein

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Computer Science

An algorithm is, very simply, a finite set of instructions designed to accomplish a particular task. Though this definition obviously associates itself with the field of computer science (as modern computer programming is based on this exact principle), the area of algorithm analysis is a heavily mathematics-influenced one. Algorithms can be used to perform any number of general functions, including but not limited to: factoring, sorting a set, searching for an element of a set that meets certain criteria, modeling and simulation, and statistical analysis. As these tasks and others like them occur with reasonable frequency in modern mathematics and computer science, there exist some standard algorithms that are typically employed to accomplish each of these types of functions. This study seeks to evaluate and compare the efficiency of a number of commonly employed searching and sorting algorithms. It will also demonstrate the process behind each algorithm discussed and develop reasonable hypotheses regarding which algorithms are best suited to particular applications.

### **“The Four Color Theorem”**

Lisa D. Taylor

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Medical Physics

The Four Color Theorem arose in the mid 19th century when Francis Guthrie questioned whether four colors would suffice to color a map in such a way that regions sharing a common boundary, other than a single point, could not share the same color. As a student at University College London, Guthrie brought this problem to the attention of one of his former professors, Augustus De Morgan. Although De Morgan was unable to answer Guthrie's question, he did introduce the problem to other mathematicians. Since the proposal of the problem a number of proofs have been developed and quickly discredited by the discovery of errors. Presently, it is universally understood that the Four Color Theorem is much too lengthy and complicated to be proven and verified by humans. While this task has been done by computer programs, confirming the validity and correct performance of the programs, again, is much too lengthy to be completed by humans. As a result, thorough examination of a proof of the Four Color Theorem is unreasonable. Instead, a general explanation and synopsis of the Four Color Theorem and its proof will be presented.

## **“Modeling Interaction between Populations of Cottontail Rabbits and Red Foxes”**

Sergei Temkin

Faculty Advisor: Stephen R. Campbell, Ph.D.

Major: Computer Science/ Mathematics

It was in my interest to create a simulation that would model the interaction between animal populations. To make the simulation more interesting, I picked Cottontail Rabbits and Red Foxes as animal types to simulate a predator-prey model, where the populations greatly affect each other. The simulation itself consists of a computer program that I made in Java that lets the user create simulations, watch the animal interactions in the simulations, and gather the population data for each time interval in the simulations. Furthermore, the parameters used in the simulation, such as life span, litter size, etc. can be varied by the user who runs the simulation. By varying some of the significant parameters such as the two described above we would see a great impact on the data gathered from the simulation, while other parameters may result in little or no effect on the data. The code for the simulation is also flexible enough for other programmers to add other animal types to the simulation.

## **“Modular Arithmetic and RSA Encoding”**

Amy Valentine, Jennifer Napier, Ben Tate

Faculty Advisor: Sarah Ann Stewart, Ph.D.

Major: Math, Computer Science, Computer Science

How do you know your credit card number is safe when you buy something over the internet? How does your bank keep your information private, even online? This presentation will demonstrate how modular arithmetic and number theory are behind the whole process of keeping information private called RSA cryptography. RSA cryptography is currently the best known method of encryption. It is used to encode private information like credit card numbers, banking information, and medical records, which allows this information to be sent over the internet.

## **Psychology**

### **“The Effects of Confidence and Auditory Distractions on Change Detection”**

Carrie A. Brown, Eileen S. Marks, Jennifer Wallace

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology, Psychology, Nursing

Change blindness is the failure to detect visual changes in scenes (Goldstein, 2007). Past research has studied the effects of visual distractions on change blindness, but few studies have been done regarding auditory distractions. McCarley, Vais, Pringle, Kramer, Irwin, and Strayer (2004) found that cell phone conversation increased the number of undetected changes during a change detection task while listening to a tape-recorded conversation did not. However, Levin and Simons (1997) found that observers usually failed to notice changes in a film with dialogue. Another factor that may be related to change detection is confidence. Levin, Momen, Drivdahl, and Simons (2000) found that participants overestimated their ability to detect changes. However, Eimer and Mazza (2005) found that when participants were confident they detected changes more quickly and accurately than when not confident. The current study hypothesizes that viewers will be less likely to detect changes in a video with dialogue than a silent video. It is also hypothesized that viewers with higher confidence to detect changes will detect more changes than viewers with lower confidence to detect changes. Approximately 30 participants will rate their level of confidence in their ability to detect changes in films and then view two short videos containing changes. One film will be silent and the other will have dialogue. It is expected that viewers will detect less changes in the film with dialogue than the silent film, and also that confident viewers will detect more changes in the films than viewers who are not confident.

### **“Effects of Odor and Odor Change on Mood”**

Margaret E. Cornwall, Carolyn A. Currey and Elizabeth L. Murphy

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology, Psychology, Psychology

Humans encounter sensual experiences every day. Many of these experiences have been found to alter overall mood and affect. Odors and various changes in odor are among some of the most frequently occurring sensual experiences each day. The effects of such sensual experiences and changes in sensual experiences have been found to effect moods. The effects of odor on mood found in previous studies include calmness, alertness, and contentedness. In this study, the effect of odor

and changes in odor on overall mood will be examined. Thirty undergraduate students in introductory psychology courses will be surveyed. A coconut solution, which will serve as the pleasant scent, and a limburger cheese solution, which will serve as the unpleasant scent will be applied to pages of the Brief Mood Introspection Scale (BMIS). This scale will be the measure for mood experienced from the scents. It is hypothesized that introduction to an unpleasant scent will negatively effect mood while introduction to a pleasant scent will positively effect mood. The results of this study could be applied to therapeutic settings for anger management programs or patients with depression.

### **“The Effect of Mood on Taste Perception”**

Hilary Goulart, Laura Musten, and Kelly Witherbee

Faculty Sponsor: Lonnie Yandell, Ph.D.

Major: Psychology, Commercial Music/Psychology, Psychology

Past studies with rats and humans have shown that when submitted to different stressful conditions, the subjects were more sensitive to the four basic tastes. For the purposes of this study, the specific emotions of happiness, sadness, and no mood were tested to see how they affected taste. In this study, thirty Belmont University students watched one of three three-minute movie clips: a comedy, a drama, or a neutral landscape scene designed to induce a happy, sad or no mood. After rating how the movie affected their mood, students sampled a salty, sweet, sour, and bitter liquid and rated the intensity of that liquid’s taste. It is expected that the students who were in a happy mood or a sad mood will report more intense tastes than those whose mood was not manipulated.

### **“The Affect of Pleasant and Unpleasant Odors on Short-term Memory”**

Barbara Hutchison, Rejana Wells & Shandus Valentine

Advisor: Lonnie Yandell, Ph.D.

Major: Psychology, Biology, Psychology/Honors

Previous research suggests that memory recall is linked to the olfactory sense. A unique neural connection exists between the olfactory nerve and the amygdala, which is associated with the experience and expression of emotional memory. This study will examine whether the type of odor affects the strength of memory recall. Twelve students from an introductory psychology course at Belmont University will be randomly assigned to one of three odor conditions. They will be asked to share experiences that relate to each of sixteen concrete nouns from a word list while being exposed to either an unpleasant odor (ammonia) or pleasant odor (air freshener). The participants will not be told to attempt to remember the words. After completing a distracter task, the participants will attempt to recall as many words from the list as they can. This study hypothesizes that participants who are exposed to the noticeably unpleasant odor at the time of memory storage will have greater memory recall than participants who are exposed to the noticeably pleasant odor at the time of memory storage will. If the hypothesis is supported, this study will provide valuable information about the process of memory storage and recall.

### **“Is the McGurk Effect Compulsory?”**

Emily Kane, Dannelle Rohrbaugh, and Clayton Rothwell

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology, Psychology, Psychology

We are constantly being bombarded by speech from many different sources. It is rare that we get to look at every source of speech, and some situations, like being on a phone, do not allow for this. But in cases where we can watch and listen to someone talk, there can be a visual influence on understanding speech. The McGurk effect in 1976 was the first scientific finding of a visual influence on speech. Researchers discovered this effect by altering a video. The resulting video was an image of someone saying “ba” and an audio track of someone saying “ga”. When participants watched the altered video, they always heard “da” (not “ba” or “ga”). “Da” is neither the visual stimulus nor the audio stimulus, but it is a different, new perceived syllable. This study will compare two groups of (approximately 30 total) Belmont introductory psychology students. Each group will receive written instructions, either informing them about the McGurk effect or not informing them. Participants will then watch the McGurk effect video and report what they heard. Participants will be exposed to the McGurk effect video a second time, but close their eyes so that they are only listening. Again, participants will report what they heard. We expect to find that the two groups will be equally likely to experience the McGurk effect.

## **“The Effects of Color Saturation and Opponent Colors on Depth Perception”**

Sarah L. Lashley and Chegameh Korvandi-Geledar

Faculty Advisor: Lonnie Yandell, PhD.

Major: Psychology, Psychology

The depth perception of colors varies in regards to the surroundings (Guibal & Dresch, 2003). This study examines the effects of opponent colors and the saturation of colors on the perception of depth. Nineteen Belmont University students answered questions while viewing a slide show containing sixty-four colored slides. Thirty-two of the slides varied whether the colors were opponent colors (red/green, blue/yellow) or non-opponent colors. Thirty-two of the slides varied whether the colors were highly saturated (less white added) or less saturated (more white added). We expect the results to show that opponent colors will appear closer than non-opponent colors, and that highly saturated colors will appear closer than less saturated colors. The importance of color on depth perception in our environment will be discussed.

## **ORAL PRESENTATIONS**

**Beaman A**

**5:00 – 6:30**

**Dr. Linda Jones, Moderator**

### **Psychology**

**5:00 – 5:15**

**“Familiarity to Invasion of Personal Space and Anxiety Level”**

Allison C. Dowling

Faculty Advisors: Lonnie Yandell, Ph.D. and William Bailey, Ph.D.

Major: Psychology

This study investigates the effects of invasion of personal space on anxiety levels of people who have different amounts of familiarity with invasion of personal space. Familiarity with personal space invasion is explained in terms of participant history of sharing a bedroom. Personal space is defined as an “area with individual boundaries surrounding a person’s body into which intruders may not come” (Sommers, 1969). Anxiety is described by psychological literature as an overall feeling of apprehension characterized by behavioral, mental, or physiological symptoms. Twenty volunteers (14 female and 6 male) from the Introduction to Psychological Science course at Belmont University participated in the study. Participants, in groups of 6 at a single table, were connected to a Biopac GSR and asked to complete a questionnaire designed for this study. The questionnaire included demographic questions and items modeled after questions from the Roommate Friendship Scale (Wiltz, 2003). Anxiety level was determined based on their Galvanic Skin Response measure. The relationship between anxiety, participant history with invasion of personal space, and the Roommate Friendship Scale will be analyzed. It is predicted that individuals with less familiarity with invasion of personal space will experience more anxiety in a crowded research setting than those who are more familiar to the invasion of personal space.

**5:15 – 5:30**

**“An Analysis of Alpha Activity During Relaxation, Alertness, and a Working Memory Task”**

Eileen S. Marks

Faculty Advisors: Lonnie Yandell, Ph.D., William Bailey, Ph.D.

Major: Psychology

Alpha activity, a type of brain activity recorded with Electroencephalography (EEG), occurs during relaxed wakefulness (Fisch, 1999). Gevins, Smith, Leong, and McEvoy (1998) found that working memory requires increased mental effort and that alpha activity decreases with increasing working memory load during verbal and spatial working memory tasks. Marks and Yandell (2006) did not find a decrease in alpha activity during an operation span working memory task. It was expected that alpha activity would be reduced during a relaxed state with eyes closed compared to an alert state with eyes open. It was also expected that alpha activity would be greater during a control state compared to activity during a verbal working memory task. Seven participants had their alpha activity recorded with a Biopac MP35 unit during four conditions: a control state, a relaxed state with eyes closed, an alert state with eyes open, and a working memory task. The working memory task was the Repertory Test (Watt, 1983) which is a paper-based task which presents 24 simple words,

each followed by five more words. Participants were asked to choose the one word of the five that was closest in meaning to the first word given. It is expected that alpha activity during a relaxed state with eyes closed will be greater than an alert state with eyes open, as well as alpha activity during a control state being greater than during the working memory task.

**5:30 – 5:45**

**“The Effect of Celebrity Endorsement and Strength of Message in Non-Profit Advertising on Social Character”**

Emily M. Kane

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Persuasion can be very beneficial when raising awareness and support for non-profit organizations. In this study, the effectiveness of persuasion is explored by varying message strength, celebrity/non-celebrity endorsers, and social character. Sixty four participants from introductory psychology classes at Belmont University filled out the Inner-Other Social Preference Scale (Kassarjian, 1962), and evaluated four different non-profit advertisements based on message strength (strong and weak) and the endorser (celebrity or non-celebrity). It is expected that inner directed individuals will be more persuaded than other directed individuals by a strong message. In addition, other directed individuals will be more persuaded than inner directed individuals by a celebrity endorser. The results of this study will prove useful to non-profit organizations seeking to raise awareness and support of their organization.

**5:45 – 6:00**

**“EEG, Working Memory, and Personality”**

Eileen S. Marks, Carrie A. Brown, Kurt Niesner, Shardé Carney

Faculty Advisor: Linda Jones, Ph.D.

Major: Psychology, Psychology, Psychology/Sociology, Psychology

While research has explored differences in EEG activity between the left and right hemispheres for several cognitive tasks, few studies have investigated hemispheric differences in working memory tasks. Gevins, Smith, Leong, and McEvoy (1998), found that as working memory load increases, more effortful processing is required. Dimond and Beaumont (1974) found that the left hemisphere is more active during effortful processing. In addition, past research suggests that extraverted individuals tend to have greater alpha activity than introverts during high arousal tasks involving mental arithmetic (O’Gorman & Mallise, 1984). For this study, electroencephalography (EEG), a non-invasive technique for recording bioelectric brain activity, was used to record alpha and beta brain activity. It was hypothesized that there would be more EEG activity in the left hemisphere during a working memory task. It was also hypothesized that extraverted individuals would have greater alpha activity than introverted individuals during the working memory task. Forty-six participants completed the Big Five Inventory (BFI-54) and then completed an operation span task while their EEGs were recorded using a Biopac MP35 Unit. This working memory task is comprised of 18 trials and requires holding words in immediate memory while verifying simple arithmetic equations. There were no differences between right and left hemispheric EEG activity during the working memory task. However, extraverted individuals did display greater alpha activity than introverted individuals during the working memory task.

**6:00 – 6:15**

**“The Effects of Focus Relevance to Skill and Internal/External Focus on Skilled Performance”**

Robert C. Fernandez

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Attentional focus is an important component to skilled motor performance, such as sports. Focus relevance to skill refers to whether the attention that is directed towards a component of a skilled task is relevant or is not relevant to the task. Internal/External focus pertains to whether one focuses on oneself or on something outside of oneself. In many previous studies there has been no separation between the effects of focus relevance to skill and internal/external focus on performance of a skilled motor task. Ford (2005) tried to separate the effects of focus relevance to skill and external/internal focus, but was not able to completely separate the two variables, as he did not test an external focus relevance to skill. This study will consist of a soccer dribbling task testing approximately 15 Belmont University men’s soccer players under four conditions. The conditions will consist of all possible combinations of internal/external focus and focus relevant/irrelevance to skill. My expected results are that focus relevance to skill is more important than focus irrelevance to skill for performance, whether it is internal or external focus. Once we understand the relationship between focus relevance to skill,

internal/external focus, and their relationships to performance then we can develop the most productive conditions for performance.

**6:15 – 6:30**

**“The Attractiveness of Revealing Clothing in Different Body Types”**

C. Renease Perkins

Faculty Advisor: Lonnie Yandell, Ph.D.

Major: Psychology

Attractiveness of revealing clothing can depend on the body type of the person. The larger the body type and the fewer clothes worn may result in lower attractiveness. Thirty Belmont University introductory psychology students viewed four line drawings. These line drawings differed in body type, large or slender, and type of clothing, revealing or not revealing. The students rated each drawing on attractiveness of style of clothing, body type, and the person. Large body type should be less attractive than slender body types. Clothing that is not revealing should be more attractive on a slender body type than a large body type. Attractiveness may depend on style of clothing and body type.

## **Beaman B**

**5:00 – 6:45**

**Dr. Darlene Panvini, Moderator**

## **Mathematics**

**5:00 – 5:15**

**“Collection, Analysis and Application of Locomotion Data in *C. Elegans* through Image Recognition”**

Sergei Temkin

Faculty Advisor: Glenn Acree, Ph.D.

Major: Computer Science/ Mathematics

In the summer of 2005, working to reproduce a paper from a research group from the California Institute of Technology, the development of a java program, *WormAnalyzer* for capturing data describing the locomotion of the *C. Elegans* was initiated. (The *C. Elegans* is one of several model systems particularly well-suited for genetic studies, since its genome is completely documented.) Throughout the 2005/2006 academic year, and into the summer of 2006, the project matured to the point that it could be tested and applied through the research projects of several biology students working within the Scholar Communities undergraduate research program. This presentation will describe the present capabilities of the *WormAnalyzer* project, as well as, outlining future directions and expansions for the project.

## **Biology**

**5:15 – 5:30**

**“*Caenorhabditis elegans* As A Model System for *Streptococcus pneumoniae* Infection”**

Kristen Sorensen

Faculty Advisor: Nick Ragsdale, Ph.D.

Major: Biology

*Caenorhabditis elegans* exhibit a pathogen specific innate immune response. *C. elegans* are a good model host for the study of bacterial pathogenesis due to a large variety of available knock-out and knock-down mutants. By testing the lifespan of wild type *C. elegans* after exposure to *Streptococcus pneumoniae*, *C. elegans* mutants were utilized to determine if there are conserved factors with the mammalian immune system necessary to combat a gram positive bacterial infection. Additionally, the effect of various bacterial virulent factors on the life span of wild type *C. elegans* was examined to determine if *S. pneumoniae* requires virulent factors similar to those needed to infect mammals. Initial results suggest that a p38 pathway is conserved in the battle against *S. pneumoniae* infection in both mammals and *C. elegans*. Additionally, *S. pneumoniae* utilizes similar virulence factors to infect both mammals and *C. elegans*.

**5:30 – 5:45**

**“Neural Pathways Involved in Olfactory Imprinting in *C. elegans*”**

Ananta Bhatt

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

Major: Biology

Neural plasticity is an interesting phenomenon that refers to the changes in the organization of the brain. These changes can occur due to stimulation of sensory neural pathways by internal or external stimuli. Olfactory imprinting is a process that leaves a permanent memory due to olfactory stimulations. This irreversible learning involves exposing an organism to an odor during a critical development period and once imprinting has occurred, exposing the organism to the same odorant during a later period to reveal the extent of imprinting through behavioral observations. To study this phenomenon, we used a temperature-dependent mutant of *Caenorhabditis elegans*. These nematodes are *tax-2* sensory ion transduction channel mutants, and these mutants allowed us to determine the importance of TAX-2 channels in imprinting. Since these channels are located on the AWC olfactory neurons, we were able to study the significance of AWC neurons in olfactory imprinting. Through this study, we have shown that *tax-2* mutants at restrictive temperatures, unlike controls, do not exhibit imprinting, and due to the relationship between TAX-2 channels and AWC neurons, we can deduce that AWC neuron is a key element in allowing olfactory imprinting to occur.

**5:45 – 6:00**

**“Determination of Soil Nutrients, Microbial Diversity, and Levels of Herbivory to Assess the Impact of *Vinca* on a Goldenseal Population”**

Amanda Simpson

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

Major: Biology

Exotic plants compete with native species, altering native communities. *Vinca*, an exotic vine, is found throughout the Warner Parks in Nashville, TN, including areas where the native and threatened *Hydrastis canadensis*, goldenseal, occurs. The number, height, and width of goldenseal plants were compared with percent cover of *Vinca*. To determine if *Vinca* changes the ecosystem dynamics where goldenseal grows, leaf herbivory, light variation, soil nutrients, and soil functional microbial diversity were assessed. Goldenseal is more prevalent in areas with minimal *Vinca*, and shows significant levels of herbivory compared to *Vinca*. The amount of Fe in the soil is positively correlated to the percent cover of *Vinca*. The percent cover of *Vinca* was greatest in areas with reduced light levels. Understanding how *Vinca* changes the ecosystem and impacts goldenseal populations might help prevent the demise of goldenseal in Warner Parks and aid in the preservation of native ecosystems.

**6:00 – 6:15**

**“Ecological Impact of *Lonicera maackii* as Determined by Soil Nutrients, Functional Microbial Diversity, Light, and Herbivory”**

Neeley Osteen

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

Major: Biology

While we know that invasive exotic plants alter native plant communities, less is known about the impact of exotics on ecosystems. *Lonicera maackii*, bush honeysuckle, can be found throughout the Warner Parks in Nashville, Tennessee. Thirty areas, representing high, medium, and low densities of honeysuckle, were assessed for soil functional microbial diversity, soil nutrients, and light levels. Levels of herbivory on honeysuckle leaves were compared to leaf herbivory on native species. Areas with fewer honeysuckles had greater levels of soil functional microbial diversity and less shade. Differences in Fe were noted in areas with high densities of honeysuckle compared to less dense areas. More herbivory was found on native leaves than on honeysuckle leaves. Our understanding of the impact of exotic species on native plant communities is enhanced when we know whether or not honeysuckle changes ecosystem dynamics.

**6:15 – 6:30**

**“Correlation of *Lonicera maackii* Density with Soil Nutrients, Microbial Diversity, Light, Herbivory, and Population Growth”**

Rejana Wells

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

Major: Biology

*Lonicera maackii*, bush honeysuckle, is an invasive exotic plant found in the Warner Parks in Nashville, Tennessee, including a parcel referred to as the Northwest Reserve. This study examined the population growth of honeysuckle over a one year period in this reserve, as well as several factors to assess the ecological impact of honeysuckle on the ecosystem. The number of honeysuckle plants and DBH were determined in twelve 10 m<sup>2</sup> plots in 2005 and 2006. Herbivory, soil functional microbial diversity, soil nutrients, and shading were analyzed in 2006. The number of recruits increased significantly in the southern and western plots, which contained the greatest number of honeysuckle. The levels of Fe and Mn in the soil were correlated to the quantity of honeysuckle in each plot. Honeysuckle exhibited less leaf herbivory than native species. These data suggest that the presence of exotic species like honeysuckle can change the ecology of ecosystems.

**6:30 – 6:45**

**“Chemosensory offspring recognition in female galliwasps (*Celestus warreni*)”**

Brian Weissand

Faculty Advisor: Steven Murphree, Ph.D.

Major: Biology

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