13th Annual
Science Undergraduate Research Symposium

Wednesday | November 30, 2016
Keynote Speaker | Dr. Stephen Carlson

“Molluscs to Mice: What Model Organisms Can Tell Us About The Brain and Behavior”

KEYNOTE ADDRESS
JAAC 4094 | Conference Room C&D
4:00PM – 5:00PM

STUDENT POSTER SESSIONS
JAAC Atrium | 3rd and 4th Floors
5:00PM – 7:00 PM

STUDENT ORAL PRESENTATIONS
JAAC | Rooms 5003, 5008, 5009, 5010
(Simultaneous Sessions)
5:30PM-7:30PM
BIOLOGY

“Decomposition Rates of Acer Saccharum and Lonicera Macckii in Mixed Litter Bags”
Anna Anderson
Faculty Advisor: Darlene Panvini, Ph.D.

Invasion of exotic species can influence decomposition rates and nutrient cycling in a forest. Leaves of exotic species have been shown to decompose faster than native species. This study evaluated decomposition rates of litterbags containing native Acer saccharum, exotic Lonicera macckii, and both species (mixed species bags). Litterbags were weighed and placed throughout an urban deciduous forest in Nashville, Tennessee at sites that contained canopies of A. saccharum, L. macckii, or both species. Litterbags were collected over six months and reweighed to determine mass lost. Acer saccharum, L. macckii, and the mixed species litter decomposed the fastest at the exotic site. The mixed species litter decomposed the fastest at all three sites. The presence of the exotic species increased the rate of decomposition of the native species. The implications of this research will add to the knowledge of changing forests and the effects of exotic species on nutrient cycling.

“Convallatoxin induces apoptosis in HCT116 colorectal cancer cells”
Sarah Anderson
Faculty Advisor: Chris Barton, Ph.D.

Cardiac glycosides have been reported to induce cellular arrest in specific cancer cells lines by attacking the Na+/K+ ATPase pump. Convallatoxin, one of the cardiac glycosides, has been reported to be effective in inducing apoptosis in 142B human osteosarcoma cells and HeLa cervical cancer cells by attacking a specific subunit of the Na+/K+ ATPase pump. This research aimed to study the effects of convallatoxin on HCT116 colorectal cancer cells in both wild-type and p53 null cell lines. Cells were treated with 50 nM convallatoxin for a 24 and 48-hour time period to visualize signs of apoptosis and decline in mitotic activity. The findings demonstrated that convallatoxin was effective in inducing apoptosis in both the HCT116 wild-type and p53 null cell lines.

“Seeking Behaviors of Nicotine”
AJ Arnold
Faculty Advisor: Robert Grammer, Ph.D.

Nicotine is one of the most heavily used addictive drug in the United States. Nicotine travels to the brain and binds to receptors where the neurotransmitter acetylcholine would normally dock. C. elegans exhibit seeking behaviors parallel to mammals when exposed to nicotine. C. elegans are the perfect model organism because of their ability to reproduce rapidly, small and easy to maintain. Making them the ideal model to investigate the effects of nicotine on the organism. In this experiment, nicotine and E. coli will test the seeking behaviors of C. elegans. In previous results, C. elegans were put onto a chemotaxis plate with 10 µL of E. coli on one end and 10 µL of nicotine. The nicotine concentration will be 3mMol or 30 mMol. The nicotine was left on the plate for three hours to diffuse. Gradually, most of the C. elegans started crawling towards the nicotine and only a few too E.coli. When changing the concentration levels of the nicotine helped better understand the seeking behaviors of the organism. According to the line graph performed the error bars were significantly large indicating that the C. elegans went towards the nicotine more than the E.coli.
Biology
“The effects of isoflurane on spatial learning and short-term memory in Danio rerio”
Curtis Brown
Faculty Advisor: Lori McGrew, Ph.D.

Postoperative cognitive dysfunction (POCD) is a medical condition characterized by an impairment in cognition following anesthesia and surgery. Typically affecting elderly patients undergoing major surgeries, this complication may interfere with everyday functions and lead to further health complications. Zebrafish (Danio rerio) are commonly used as a model organism to study mechanisms of brain function and dysfunction, exhibiting similar neural physiology and pharmacological responses to that of humans. The objective of this study was to evaluate the effects of isoflurane, a halogenated ether used in general anesthesia, on short-term memory and to identify any possible contributions to cognitive impairment in zebrafish. Through operant conditioning, the fish were trained to discriminate between colors in a T-maze, and treated with isoflurane for varying times to observe changes in spatial learning and short-term memory. Choice latency times and choice accuracy were recorded for each treatment group and compared to controls. Further research into current anesthetic agents might lead to the development of less harmful, more efficient drugs for anesthesia.

Biology
“Disinhibition by Ethanol on C. elegans Towards Bacillus thuringiensis”
Samantha Bush
Faculty Advisor: Robert Grammer, Ph.D.

Alcohol has a wide variety of effects on physiology and behavior. One of the most well recognized behavioral effects is disinhibition, where behaviors that are normally suppressed are displayed following intoxication. Caenorhabditis elegans are a model organism because of their ability to reproduce fast, they are easy to maintain, and have a genome similar to humans. In this experiment, C. elegans are washed with ethanol at dilutions of 100 µl, 200 µl, 300 µl, and 400 µl. The C. elegans are then placed on a chemotaxis plate and monitored for two hours to see their attraction to the bacterium Bacillus thuringiensis. The next step of this experiment will be to place the C. elegans, after they have been washed with ethanol, in a 96 well plate with Bacillus thuringiensis and monitor the number of worms that ingest and die from the bacterium. Preliminary research shows that there may not be any significance between the ethanol dilution and the C. elegans attraction to Bacillus thuringiensis.

Biology
“The Response of a Native and Exotic Snails to a Native Crayfish Predator”
Jasmine Conyers
Faculty Advisor: John Niedzwiecki, Ph.D.

Predators and prey exert important selection pressures on each other. Prey often coevolve with their predators, and prey traits that allow them to avoid predation. Detecting the chemical signal, or kariomone, of a predator can allow a prey to react and avoid predation. Snails have been shown to react to karimones of crayfish predators. If Chemical detection of predators is very specific a novel potential prey species may not be able to detect the presences of a predator. We tested native snails (Elimia laqueta) and Exotic snails from a pet store (Nerite family) against native, Orconectes durelli Kariomones and recorded their position and movements over one hour. Although there were differences in the amount of time the snails spent in and out of water, neither snail showed a reaction to the predator cue. Since we failed to elicit the know response in the native snail, we are unable to make conclusions about the exotic snails ability to react to those same kariomones.
Zebrafish, or Danio rerio, are considered a model organism because they have been well studied and characterized, and because they have strong homology to humans. This experiment was designed to study the memory of zebrafish under the effect of alcohol followed by treatment with piracetam. Ethanol is a psychoactive, neurotoxic, central nervous system depressant that is widely used as a recreational drug by humans. Multiple studies have linked chronic alcohol use with brain damage, specifically the hippocampus (Ryabinin, 1998). Piracetam is classified as a nootropic, which has been shown to improve and enhance cognitive abilities. Many studies have shown that zebrafish exposed to piracetam had improved working memory. One experiment showed that zebrafish exposed to piracetam performed better in the plus maze learning task than the controls (Grossman et. al, 2011). There was also a study in which piracetam was successfully used to treat pesticide-induced memory impairment in rats (Kosta et. al, 2013). In the current experiment, zebrafish were observed to see whether ethanol-induced memory impairment could be reversed or alleviated by piracetam. Zebrafish memory was tested using the T-maze and visual color cues on each arm of the maze. Control fish performance was compared to fish treated with ethanol only as well as fish treated with both ethanol and piracetam.

Studies indicate that electrolyte levels have clinical implications for health and wellness. In model organisms, electrolyte imbalance has been linked to a number of physiological disorders. With this evidence, the question asked is whether sodium chloride levels dictate anxiety levels of organisms. The zebrafish (Danio rerio) was used to evaluate this relationship, due to the fish’s capacity to change in response to environmental factors, and its testability using a novel dive tank. Three groups were tested: a control group with standard conditions, a group with exposure to 0.3 M sodium chloride for three days, and a group with exposure to 0.3 M sodium chloride for twenty-one days. Data was statistically analyzed using Microsoft Excel. It was shown that fish exposed to salt for a short period of time experience higher levels of anxiety. The benefits of this study could have clinical significance, specifically for diagnosis and treatment of electrolyte imbalance. Also, there is significance for the scientific community, as more is understood about the neurophysiology of zebrafish.

Trophic cascades occur among ecosystems, improving the health and populations of prey items on an oyster reef such as the Southern Oyster (Crassostrea virginica). Using tanks divided each into 2 chambers, the feeding rates on the Southern Oyster by two species of crabs found in the Gulf of Mexico were observed. A caged predator, also found in the Gulf, was placed in half of the chambers to see how its presence changed the amount of oysters preyed upon by the different crab species. The presence of the predator will affect the feeding behavior of both the crab species, causing them to consume less spat. Trophic cascades keep ecosystems healthy by keeping populations in control. The presence of predators, such as the Toadfish (Opsanus beta), keeps an oyster reef from collapsing. Both Mud Crabs (Panopeus sp.) and Blue Crabs (Callinectes sapidus) will by indirectly affected by the presence of the caged predator and decrease their predation.
Aquatic turtles inhabiting a ~5 ha palustrine emergent wetland adjacent to Tennessee State University Wetland in Nashville, Tennessee were examined for leeches as a component of a multi-year mark and recapture study. Leeches serve as bioindicators in aquatic environments, and are useful in determining the biological condition of aquatic ecosystems. Aquatic funnel traps were baited and deployed weekly from June – September 2016 to aquatic turtles. Each captured turtle was weighed, measured, sexed, marked, and examined for external leeches. All located leeches were removed and preserved for later identification. Turtle species captured during this study, included the Common Snapping Turtle (*Chelydra serpentina*), Stinkpot (*Sternotherus odoratus*), Spiny Softshell Turtle (*Apalone spinifera*), and the Red-eared Slider (*Trachemys scripta elegans*). The leeches that were collected from the turtles represented four different genera under phylum Hirudinea, including the *Desserobdella*, *Placobdella*, and *Helobdella*. Collectively, these data can be used to understand parasite-host relationships and how patterns in leech abundance and richness vary throughout the active season.

**The effect of caffeine on motor movement of *Caenorhabditis elegans***

Madeline Johnson  
Faculty Advisor: Robert Grammer, Ph.D.

*Caenorhabditis elegans* is a small nematode that is found worldwide and its sequenced genome, short life span, transparent anatomy, and inexpensive cost make it efficient for experimental purposes. Widely consumed in foods and beverages, caffeine is a psycho-stimulant, meaning it temporarily induces improvements in both mental and physical functions. Recently, a study performed at Belmont University suggested that the concentration of caffeine that *C. elegans* are exposed to has an effect on the locomotion toward an attractant. The purpose of this study was to determine if various concentrations of caffeine could affect the chemotaxis of *C. elegans* even after a short exposure time of three minutes. This study concluded that the nematode shows a significant chemotaxis when treated with the 20mM dilution of caffeine, but does not chemotaxis significantly towards the attractant when treated with the 10mM dilution. When treated with 1mM caffeine solution, the chemotaxis index was not significantly different than the DI water control treatment. When treated with 10mM caffeine, worms often negatively chemotaxed away from the attractant, creating a large standard deviation. The plate set-up used is sensitive to small movements. Thus, both the set-up and counting method used may account for the large standard deviations that were obtained.

**The response of naive and experienced snails to a predator cue***

Shirley Kyere  
Faculty Advisor: John Niedzwiecki, Ph.D.

Prey detects predators through chemical cues and these chemical cues affect prey behavior. Since *Orconectes durelli* crayfish and *Elimia laqueta* snails live in the same environment, we were interested to determine if habituation would alter their antipredator response. Snails were habituated for 3 days in a pre-treatment and assigned to a cup split between predator and control treatments. We compared the anti-predator reaction of snails to kairomones or controlled water based on whether or not they had been continuously exposed to those treatments previously. Although snails from both treatments were very active, there was no significant difference based on prior experience with or presence of kairomones in either anti-predator behavior or movement. The hypothesis that naive snails would exhibit higher anti-predator response compared to experienced snails when exposed to predator cue was not supported.
Biology

“Increased mortality and reduced seizure threshold in SCN1A knockout mouse model”
Crystal Lemus
Faculty Advisor: Jing-Qiong Kang, Ph.D. (Vanderbilt University)

Mutations in GABAA receptor subunits and the neuronal sodium channel SCN1A have been frequently associated with patients with epilepsy. Truncation mutations in both GABRG2 and SCN1A have been associated with the most severe kind of epilepsy, Dravet syndrome. We have previously characterized the Dravet syndrome mouse model carrying GABRG2(Q390X) mutation. Here we characterized the survival and seizure threshold of mouse model of Dravet syndrome associated with SCN1A mutations. Up to date, about 80% of Dravet syndrome is caused by SCN1A loss-of-function mutations. Patients with Dravet syndrome have refractory seizures, compromised cognition, and increased sudden death likely resulting from seizures and poor prognosis as well as other neuropsychiatric comorbidities. We hypothesize that deficiency or loss of function in Scn1a in a mice would cause a similar phenotype as seen in human epilepsy patients such as increased mortality and reduced seizure threshold. Therefore, a Scn1a deficient mouse model could be utilized for understanding human epilepsy with SCN1A mutations. We have acquired Scn1a heterozygous knockout (Scn1a+/-) mouse line and bred it with C57BL/6J. We have quantified the survival rate of the mice before 2 months and tested the seizure threshold with pentylenetetrazol (PTZ, 50mg/kg, ip) and scored seizure severity based on Racine scale. Our results indicated that there was increased mortality and reduced seizure threshold in the Scn1a+/− heterozygous knockout mice, reminiscent of human patients carrying SCN1A mutations. We thus conclude that Scn1a+/− heterozygous knockout could be a good model to study epilepsy and to compare with the mouse model carrying GABRG2(Q390X) mutation.

Biology

“Effects of Epigallocatechin-gallate and Enoxacin on HeLa cells”
Anna Margaret McDonnell
Faculty Advisor: Chris Barton, Ph.D.

Fluoroquinolone antibacterial drugs, such as enoxacin, have been shown in recent studies to have antitumoral properties. Similarly, green tea polyphenols, such as epigallocatechin-gallate (EGCG), have shown to be effective antitumoral and synergistic agents. However, the effects of these drugs on cervical adenocarcinomas have not been fully established. Cervical Adenocarcinoma is an aggressive cancer of the endocervical lining. Novel chemotherapeutics are needed to circumvent harsh side effects of currently used treatments for this carcinoma. Here, we detail the effectiveness of both enoxacin and EGCG as antitumoral agents in HeLa adenocarcinoma cells. Both drugs showed significantly lower viability and increased amounts of apoptosis compared to untreated controls. Additionally, the drugs in combination show an additive effect on HeLa cells. In conclusion, these findings indicate the effectiveness of enoxacin and EGCG both individually and in conjunction as antitumoral agents against cervical adenocarcinoma in vitro.

Biology

“Treatment effects of emetine on HCT-116 cells”
Kerry Sommers
Faculty Advisor: Chris Barton, Ph.D.

Emetine, a natural compound originating from ipecac roots, has been utilized as a chemotherapeutic agent due to its apoptosis-inducing effects. Emetine has been used primarily for the treatment of lung and blood borne cancers, however there is little research on the effects of emetine on colon cancer. This study addresses the effect of emetine on the proliferation and death of HCT-116 colorectal cancer cells. The cells were treated with three different concentrations of emetine over three time points. After determining that emetine had the capacity to kill the colon cancer cells, fluorescent microscopy was used to determine the mode of cellular death. The results of the microscopy analysis revealed that emetine inhibited proliferation and induced apoptotic cell death in the HCT-116 cells.
In order to explain seemingly non-adaptive behavior in animals, researchers often look to suites of correlated behaviors called syndromes. Aggressive behavior in crayfish may be beneficial in scaling conspecific dominance hierarchies, but traits of high aggression could be linked to other novel traits, such as high levels of boldness, which could be detrimental in the presence of a predator. We studied individual performances of *Orconectes durelli* crayfish in a series of test, interpreting boldness as a latency to emerge from shelter following a simulated attack, and scoring aggression based on competitive interactions between size-matched crayfish. We suspected the bolder crayfish of each matched pair to have the higher aggression score. A chi-squared analysis of the test results shows Marginal significance that supports our hypothesis, suggesting that aggressive traits are linked with bold traits. We are running more trials and, if confirmed, our study suggests a potential example of a behavioral syndrome in *Orconectes durelli*.

Human activities introduce potentially harmful chemicals into the natural environment, but the introduction of natural elements, such as nitrogen, may be equally detrimental. This study examined the effects of nitrogenous fertilizer on decomposition of leaves from native and exotic plant species. The effects of canopy cover type were also considered. Leaves of native (*Acer saccharum*) and exotic (*Lonicera maackii*) species were placed in leaf litterbags. Half of the bags included fertilizer, while the other half had only leaves. Bags were weighed and deposited onto the forest floor; one litterbag was removed every three weeks for six months and reweighed to determine mass lost. Both *L. maackii* and *A. saccharum* decomposed more rapidly in the presence of added nitrogen. Additionally, *L. maackii* decomposed quicker than *A. saccharum* overall. These results suggest that the presence of additional nitrogen can exacerbate the role that exotic species have on decomposition and nutrient cycling.

Previously, researchers outlined procedures that can be utilized to detect respiration in *C. elegans*, which involved the use of spectrophotometry; they also reported worm viability and acidification based on absorbance and the effect of sodium azide, a mitochondrial inhibitor (Parrish and Grammer, 2012). In their experiment, only glucose was utilized to study its effect on acidification. This study aimed to solidify the procedures from the initial study. Furthermore, the effects of glucose, fructose, maltose, and *E. coli* on respiration rate were also studied. It was hypothesized that each sugar and *E. coli* would have detectable respiration, but *E. coli* and glucose would have the strongest detection. Instead of using spectrophotometry, pH probes were utilized to detect the change in pH over 60 minutes. Worm viability experiments showed that few nematodes die over a sixty-minute period in the absence of sodium azide. With sodium azide, there are rarely any live worms at each time interval tested. Baseline experiments showed minimal differences in respiration of worms treated in sodium azide and worms not treated in sodium azide. Furthermore, the addition of 10μL of 0.25M sugar showed minimal differences. However, the addition of 10μL of *E. coli* showed a greater change in pH levels for the worms not treated with sodium azide. These findings can be further explored to see if other bacteria that *C. elegans* are attracted to have similar effects on respiration rates.
Biology
“Differences in Plant, Macroinvertebrate, and Microbiota Diversity on a Well-Established Green Roof and a New Green Roof”
Sargoel Rezanejad
Faculty Advisors: Chris Barton, Ph.D., and Darlene Panvini, Ph.D.

Green roofs, patches of vegetation on the roofs of buildings, provide many economic benefits for humans. They also help restore biodiversity by housing diverse species of organisms that interact to provide structural diversity and ecosystem functionality. DNA barcoding, a modern taxonomic tool, is a more recent technology used to identify organisms to the species level. We collected plants, macroinvertebrates, and bacteria from two different green roofs (an old one and a new one) on a university campus in Nashville, Tennessee to assess diversity while examining DNA barcoding as a taxonomic tool. Pitfall traps, sweep nets, and ecoplates were used to determine macroinvertebrate and microbial diversity. The newly-established green roof exhibited more species of plants per area and more structural complexity, thus greater diversity of macroinvertebrates and bacteria. This suggests a relationship between plant structural complexity and overall diversity. DNA barcoding was mostly effective in identifying plants to the genus level.

Biology
“Comparison Between Established Versus Newly Created Green Roofs Focusing on Microbiology, Macroinvertebrates and Green Roof Flora”
Kelsey Saint Clair
Faculty Advisors: Chris Barton, Ph.D., and Darlene Panvini, Ph.D.

Green roofs enhance urban diversity by creating green spaces in metropolis settings. Little research has examined the relationship between soil microbial, macroinvertebrate, and plant diversity on green roofs. We compared diversity on two green roofs at different stages: established versus newly-established. We predicted that the older green roof would have more species diversity. DNA barcoding was used to identify plants to genus level, pitfall traps and sweep nets were used to determine macroinvertebrate diversity, and Ecoplates were used to assess microbial functional diversity. The newly-established green roof exhibited more species of plants per area and more structural complexity. Greater diversity of macroinvertebrates and bacteria were also found on the newer green roof. The intermediate disturbance hypothesis could explain the greater diversity on the new green roof. If we know how diversity changes over time, this research can provide insight into how green roofs can be managed to enhance urban diversity.

Biology
“Caffeine’s Effect on Chemotaxis of C. elegans at Various Stages of Life”
Emily Shearon
Faculty Advisor: Robert Grammer, Ph.D.

There is a body of evidence to suggest that the vast majority of nervous system development is complete by the L1 life stage of C. elegans. However, nothing has been found that discusses the ability of worms at this stage to perform chemotaxis. This study aims to see how different concentrations of caffeine exposure affect L1 worms’ ability to chemotax when compared to worms at the L4 stage of life. Caffeine is of significant interest in this study due to the large amount known about how the drug affects cognitive and motor skills in C. elegans and, more broadly, because it is consumed on a daily basis by so many people worldwide. Our data suggests that L4 worms treated with caffeine follow a similar trend to previous Belmont University research (Nunez & Grammer, 2015). Though it was expected that L1 worms would also follow this trend after caffeine treatment, the pattern observed was quite different. Further replicates of the L1 experiments will be performed in order to more fully determine if caffeine concentration significantly affects chemotaxis ability in these worms or if these results are due solely to L1 worms’ inability to move as well their L4 counterparts.
**Biology**  
“Expansion on the Nematode Scent Detection Test: Evaluating *C. elegans* Attraction to Non-Small Cell Lung Cancer”  
Brian Song  
Faculty Advisor: Robert Grammer, Ph.D.

*Caenorhabditis elegans* (*C. elegans*) have been shown to exhibit positive chemotaxis towards the secretions of cancerous cells. By applying this behavior clinically, a cancer screening system has been devised and has shown effectiveness for breast, gastric, and colorectal cancers. Prior research has shown that the nematode is also attracted to cervical cancer, specifically HeLa cells. It has not been assessed whether the screening system would be useful for lung cancer. The objective of this project is to evaluate if *C. elegans* displays attraction to A549 cells, a cell line derived from non-small cell lung cancer, when WI-38 (normal human lung fibroblast tissue) is used as a control. It has been observed previously that specific dilutions to the millionth and ten millionth have garnered positive chemotaxis. Results have shown positive and negative chemotaxis as expected regarding the specific dilutions of conditioned A549 medium with fresh medium as the control, and consistent negative chemotaxis with all dilutions of WI-38 when fresh medium is used as the control. With A549 confirmed as the positive control and WI-38 as the negative control, a choice assay was carried out between the two cell lines, with the attractant being used A549 medium and the control being used WI-38 medium. Results showed positive chemotaxis to the millionth and ten millionth dilutions of used medium.

**Biology**  
“Behavioral syndromes of *Elimia* snails in response to Crayfish predation threat”  
Ryan Tapley  
Faculty Advisor: John Niedzwiecki, Ph.D.

Behavioral response can allow animals to optimally react to their environment. However, behavioral syndromes may inhibit this optimal response if there is a correlation between certain behaviors. Aquatic snails that are more active will be more successful when foraging for food and mating but their boldness endangers them when it comes to predator response. We tracked *Elimia* snail movement in cups of control creek water and then observed the same snails in creek water with *Orconectes durelli* crayfish kairomones to see if the activity/boldness syndrome was present in individual snails. We found some correlation of behaviors but the R² value was very low, suggesting that factors other than a syndrome accounted for most of the variation. However, we failed to elicit a strong predatory response- unlike similar experiments in the past- so we could not come to a strong conclusion about whether such a syndrome exists or not.

**Biology**  
“Effect of *Sedum rupestre* on Non-Sedum *Dianthus kahori* When Planted Together on an Extensive Green Roof” *(Abstract Not Available)*  
Laura Horton, Caroline Glover, Dylan Adler  
Faculty Advisor: Darlene Panvini, Ph.D.

**Biology**  
“The Moss-terious Effect of Herbs on a Green Roof” *(Abstract Not Available)*  
Sandra Bojic, Kerra Gaona, Kelsey Saint Clair  
Faculty Advisor: Darlene Panvini, Ph.D.

**Biology**  
“Mosses and Sedum Affect Green Roof Substrate Temperature” *(Abstract Not Available)*  
Bethany Strother, Kylie Lawrence, Sara Haney  
Faculty Advisor: Darlene Panvini, Ph.D.
“Insight Into the Chemotaxis of \textit{Caenorhabditis Elegans} Toward Pathogenic \textit{Bacillus Thuringiensis} Strain 4A4 Using Chemosensory Deficient Nematodes”

Stacey Crockett  
Faculty Advisor: Robert Grammer, Ph.D.

\textit{Caenorhabditis elegans} (\textit{C. elegans}) is a model organism that is widely used in biological research. One of these areas of study involves the understanding of how \textit{C. elegans} react to different types of pathogenic bacteria, such as \textit{Bacillus thuringiensis} Strain 4A4 (\textit{Bt}). \textit{Bt}—a type of environmentally compatible pesticide—in its sporulated form has been shown to be not only be extremely lethal to \textit{C. elegans} but also appears to attract \textit{C. elegans} toward it. However, it is unclear as to what exactly is attracting \textit{C. elegans} to the bacteria in the first place. One theory is that the bacterium emits specific chemicals that \textit{C. elegans} can perceive through specialized cilia and sensory neurons—those that can detect either volatile chemicals (olfactory) or water-soluble chemicals (gustatory). A series of chemosensory deficient \textit{C. elegans}—those with mutations in the sensory neurons AWA, AWC, and ASE—were used in a chemotaxis assay to help determine the chemical nature of \textit{Bt}. Upon statistical analysis, it would appear that the most significant difference in the attraction of \textit{C. elegans} towards \textit{Bt} involve the double knockout mutation of both AWA and AWC, which ultimately affected the ability of the worms to sense volatile chemicals in its environment. However, the results also indicate that it is possible that more than one type of chemical is being emitted from the bacteria. Further biochemical analysis of the bacterium itself could lead to a better understanding of its exact chemical make up and thus the nature of the attraction.

“Catechin Isolation of \textit{Rosa damascena} Implies Novel Melanoma Prevention”

Nick Orji  
Faculty Advisor: Rachel Rigsby, Ph.D.

Melanoma is a virulent form of skin cancer that stems from the pathological growth of melanocytes. The melanin produced by these melanocytes can either be phaeomelanin or eumelanin, the latter of which has inherent properties that provide greater protection from the damage caused by UV rays; this makes eumelanin-dominant individuals far less prone to developing melanoma. Tyrosinase is a critical enzyme in the melanogenesis pathway. Inhibition of this enzyme was examined via the introduction of the biomolecule catechin. This molecule has been shown to have inhibitory effects on tyrosinase. This study tested the effects of catechins found in \textit{Rosa damascena} on the activity of tyrosinase. The catechins found in this species of roses showed no inhibition on the activity of tyrosinase. This shows that catechins from certain sources may be better suited for the inhibition of tyrosinase.

“Isolation of Catechins from Granny Smith Apples for Analysis of Inhibition of Tyrosinase”

Sarah Maxwell  
Faculty Advisor: Rachel Rigsby, Ph.D.

Catechins, a flavanol and antioxidant, have been thought to be beneficial to overall human health for a small time now. There is reason to believe they are capable of inhibiting tyrosinase, the enzyme that catalyzes the first major step in the synthesis of melanin converting L-tyrosine into dopaquinone. The current project isolated catechins and concentrated them from Granny Smith Apples via amalgamation, filtering, and distillation. The presence of catechins in the apples was confirmed via UV-Vis spectroscopy. Utilizing a catechin standard, a curve was constructed so that the concentration of catechin per gram of apple could be calculated. The effect of these isolated catechins on tyrosinase was monitored in an assay containing a standard volume of tyrosinase and L-tyrosine via UV-Vis Spectroscopy. The type of inhibition observed by catechin was also determined.
NEUROSCIENCE

Neuroscience
“The Relationship Between Acute Stress and Behavioral Sensitization in Apomorphine Treated Danio rerio”
John Longenecker
Faculty Advisor: Lori McGrew, PhD

Zebrafish are a model organism for neuroscience research because their central nervous system is similar to humans’. One such similarity are dopamine receptors, a class of GPCRs. Dopamine is the primary neurotransmitter involved in the reward pathway. Psychomotor stimulants such as cocaine and amphetamines act on dopamine pathways. Furthermore, after repeated exposure to such drugs, the motor stimulus response is enhanced, a principle called behavioral sensitization. To combat this occurrence, some rehabilitation clinics help to gently lower patients’ dopamine levels by prescribing other dopamine agonists. One such drug is Apomorphine, which is only recently being investigated in this area. The hypothesis of this study was that apomorphine will increase dopamine levels and elicit anxiogenic behavior, which is another side effect seen during rehabilitation. Data was analyzed using a two-factor ANOVA, with replication. Results indicate that Apomorphine does not elicit anxiogenic behavior, which may add to a growing body of evidence that suggests Apomorphine is a suitable drug for rehabilitation clinics.

Neuroscience
“Chemotaxis of Caenorhabditis elegans with Bacillus thuringiensis 4A4 in vegetative and sporulated growth stages”
Meghan McGath
Faculty Advisor: Robert Grammer, Ph.D.

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

Neuroscience
“Investigation of p53 activation in HCT116 with the sesquiterpene Beta-Caryophyllene”
Diana Neculcea
Faculty Advisor: Chris Barton, Ph.D.

Beta-Caryophyllene is a natural bicyclic sesquiterpene widely found in the essential oils of many common herbs and plants. The biologic properties of B-Caryophyllene have experimentally demonstrated anti-proliferative, antioxidant, antimicrobial, and anti-inflammatory effects. In this experiment, we investigated variances in the anti-proliferative effects of B-Caryophyllene on the isogenic human colorectal cancer cell line HCT116 with wild-type p53 (+/+) and HCT116 without p53 (-/-). Both conditions showed a dose-dependent response in cell growth inhibition to treatment with increasing concentrations of B-Caryophyllene. The nontoxic dose of 150uM B-Caryophyllene significantly decreased the mitotic cell count in the p53 (+/+) HCT116 by over 50% in the first 24-hours. The same IC50 value was used with the p53 (-/-) cells for consistency, however there was only a 10% decrease in the first 24 hours. This
discovery suggests that the presence of p53 may play a role in the effectiveness of B-Caryophyllene as an anticancer agent.

Neuroscience
“The Effect of Anandamide on Working Memory in Danio rerio”
Sam Zacovic
Faculty Advisor: Lori McGrew, Ph.D.

Anandamide is a naturally occurring psychoactive cannabinoid that neurons release to inhibit the stressful effects of cortisol. Anandamide interacts with CB1 and CB2 receptors, located in the central and peripheral nervous systems. This endocannabinoid system is active in a wide range of physiological processes such as sleep, hunger, memory, and stress. CB1 and CB2 receptors are present throughout the medial pallium in the amygdala and in the hippocampus, structures that are thought to be involved in associative learning. Zebrafish (Danio rerio) were chosen for this study because of their extensive endocannabinoid system. The interaction of cannabinoid activation with working memory was examined. The fish executed a T-maze task with reward and punishment training. The right arm of the maze contained a reward (conspecifics) while the left arm of the maze included a punishment (confinement). The fish were trained until they could consistently navigate to the right arm of the maze. Once trained, the fish were submerged in anandamide solution to stimulate internal cannabinoid activity. It was hypothesized that a lower dose of anandamide would not have an effect on T-maze performance, but a high dose would produce inhibitory effects on their recently learned association.

Neuroscience
“The Effects of Dopamine on Learning and Certainty in Zebrafish”
Stephane Morin
Faculty Advisor: Lori McGrew, Ph.D.

Previous studies suggest that the neurotransmitter dopamine plays a crucial role in the development of memories and learning via positive reinforcement. Dopamine has been shown to influence aversion learning as well. (Schmidt, R., G. Morris, E. H. Hagen, R. J. Sullivan, P. Hammerstein, and R. Kempter, 2009). In a study done early this year, it was shown that situations in which animals learn to avoid negative stimuli are regulated by dopamine (Dani, John, PhD., 2016). In the present study, this effect was explored to determine whether extra dopamine could further increase the natural learning ability of Zebra fish. It was hypothesized that the increase in dopamine in the fish would lead to a greater learned response. To test this, the fish were all trained in the same T-maze under the same conditions. The fish were split into three groups – a control group – a pre dose group - a post group. The maze testing followed a basic reward - punishment system to activate both positive reinforcement and aversion pathways. After the final testing for each group, data were analyzed to determine whether each fish took the right path on the T-maze; the total time spent to complete the maze; and the time each fish spent latent in the T-maze. These figures can help determine whether the fish knew the right choice, and how certain the fish were in that decision (time latent compared to total time).
Urbanization is one of the leading causes of local extinctions and loss of biodiversity, and canopy cover reduction as a product of urbanization creates physical and chemical changes in streams that impact biotic community assemblages. Aquatic macroinvertebrates experience varying sensitivities to environmental changes; therefore, they may act as bioindicators for poor stream health. This study compared macroinvertebrate diversity and composition in riffles of open canopy and closed canopy segments in two streams, and diversity was quantified using biotic indices. Indices representing macroinvertebrates by tolerance level indicate no significant difference between the open canopy and closed canopy sights of each stream. However, a difference in water quality between streams was observed, though this may be expected as the streams were in contrasting areas of urbanization. This suggests that the effects urbanization has on stream macroinvertebrate communities in the Nashville area may be less attributed to canopy cover reduction and more so to another environmental player.

Chemical cues are an important factor in the optimal foraging behavior of snails and their interactions with predators, and directly affect the behavior of prey. The reaction, or antipredator behavior, of prey organisms may be indicated by the size of the prey. In this experiment we tested if snails of different sizes would have different reactions and behavioral responses to chemical cues (kairomones) of their natural predators, the crayfish. Small and large snails were isolated, and exposed to water inhabited by crayfish and their antipredator behavior was observed. It was found that small snails were more reactive to native predator kairomones than large snails. Large snails maybe less If their shells protect them better from Crayfish. Crayfish could then be seeking a higher reward by preying smaller snails. From these results we would predict that large snails are less vulnerable to crayfish attacks than small snails.
CHEMISTRY AND PHYSICS

Chemistry and Physics
“Comparison of Baseball Helmets Padding Using Force Sensors”
Nicholas W. Egli
Faculty Advisor: Davon Ferrara, Ph.D.

Baseball helmets are constructed to dampen the force of the baseball on impact. Newer pad technology claims to minimize the force experienced by the head during impact. To determine the effectiveness of the pads, a Tekscan FlexiForce A201 sensor was wired and calibrated for forces up to approximately five hundred pounds. The dampening force of two types of inner-materials of the same model of helmet, thermoplastic urethane (TPU) padding and traditional foam padding, were compared. Baseballs were shot at an average speed of ninety miles per hour at the materials with the force sensor behind them, and the results showed that the new material, TPU padding, provided more dampening force than the traditional foam padding. Results indicate that the TPU padding is more effective in dampening the impact force than the foam padding.

Chemistry and Physics
“Physics in Tennis: Analyzing and Modeling Tennis Shots”
Cedric Dujacquier
Faculty Advisor: Steve Robinson, Ph.D.

A tennis ball is subject to numerous forces during its flight. In order to measure and analyze the importance of these forces, videos of different tennis shots were made. Measurements of different variables such as velocities, acceleration, and position were made in order to model the shots. The two main shots, top spin and slice, were modeled on VPython. The models on VPython include the drag force and the friction force when the ball bounces to help us to analyze the complete ball trajectory. Results explain how these spins change the ball trajectory and the height of the bounce.

Chemistry and Physics
“Computer Simulations and Best Practices for College Physics”
Jonathan Rankin
Faculty Advisor: Steve Robinson, Ph.D.

Finding innovative ways to instruct students in science is an important step in improving education, and is the prerogative of academia. This research focuses on effective implementation of technology in physics teaching methods. We used a basic undergraduate physics class at Belmont University to test the value of integrating simulations of various physics concepts, built in the Python programming language, into the curriculum. The students’ understanding was both objectively evaluated and self-reported. We found there was no statistically significant difference between groups receiving the simulation, watching a video illustrating the concepts, and receiving no additional help outside of the textbook. This research will provide physics teachers with evidence to inform the creation of their course content and instructional practices.
Chemistry and Physics

“Cost-Efficient Microfluidic Devices to Determine Growth Rate of Yeast Cells and Sort Microbeads by Size”
Hannah Burnette, Kara Garrett
Faculty Advisor: Krista McBride, Ph.D.

Microfluidics is an emerging area of research focusing on controlling fluids in channels typically on the scale of micrometers. Although its possible uses being investigated are diverse, some areas of focus are medical, such as its use in early detection of infectious diseases and cancer. One setback with microfluidics devices being used in these studies is the lack of availability. These devices require expensive and complicated methods to build them, limiting the accessibility of such technology. Therefore, our project focuses on the development and use of microfluidic devices by less expensive and more accessible means. Our project explores the capability of microchannels to isolate and capture yeast cells as well as sort microbeads based on size.

Chemistry and Physics

“Development of a Model Metal Amine Complex and Projections of Physical Properties via Density Functional Theory Algorithms”
Emily Cottingham
Faculty Advisor: Justin Stace, Ph.D.

CP2K, with its free, open-source code, is a powerful computational tool that can be utilized to analyze real and hypothetical molecules to determine various quantum chemistry calculations including vibrational energy and bond energy. The CP2K software is used to determine physical parameters of a hypothetical copper square-planer nitrogen molecule similar to a series of complexes under study in our laboratory. The results of the computational work will assist in the characterization of the IR and the electronic spectra. The potential-energy map of the reaction of a four-coordinate copper(II) Schiff-base with an acid is developed to give insight into the mechanism of a ligand-exchange reaction.

Chemistry and Physics

“Synthesis, characterization, and unusual solvation and luminescent properties of terbium amine complexes.”
Libby Ligon
Faculty Advisor: Justin Stace, Ph.D.

Previous research has been done to begin synthesizing various lanthanide metal complexes with amines. Inner-transition metal amine complexes exhibit unique properties and have potential for application in biological-mimic catalysis, photocatalysis, and photoluminescence. Here, three terbium-amine complexes have been synthesized by the reaction of terbium(III) nitrate with 13daprop (1,3-diaminopropane), 15dapent (1,5-diaminopentane), and phen (1,10-phenanthroline) in methanol. The off-white product precipitates at -20°C overnight and is captured via filtration. The Tb(13daprop) and Tb(15dapent) solids are insoluble in all common solvents, but will form colloidal suspensions in water, while the Tb(phen) solid yields colloidal suspensions in all common solvents, including water. The colloidal mixtures strongly absorb ultraviolet radiation, but are completely transparent in the visible and near IR. The diamine complexes are weakly luminescent when under UV irradiation, while the phen adduct exhibits very strong visible luminescence. Interestingly, the phen adduct’s luminescence is reversibly quenched by the addition of water. The complexes were characterized by FTIR. The photophysics of all three compounds are discussed.
Chemistry and Physics
“Symmetry breaking in nanorod synthesis using metal salts”
Sarah A. Cannavino
Faculty Advisor: Davon Ferrara, Ph.D.

Metal nanoparticles (NPs) have been investigated for applications that range from medical imaging, single-molecule detection, and quantum computing. Research in NP synthesis will continue to be a highly competitive field, and synthesis protocols often differ from one research group to another. The exact mechanism for symmetry breaking in nanorod synthesis using hexadecyltrimethylammonium bromide (CTAB) and silver nitrate (AgNO₃) were not understood. We analyzed the gold NP solutions using absorption spectroscopy. In the CTAB method, the increasing prominence of a second peak above 700 nm with increasing concentrations of silver nitrate was consistent with the formation of nanorods. Different metal salts in conjunction with CTAB were used to create gold-alloy NPs with and without silver nitrate to determine what other compounds may lead to symmetry breaking in the synthesis process.

Chemistry and Physics
“Greening the Synthesis of Virstatin: Finding an Alternative Solvent to Dimethylformamide”
Morgan McCauley
Faculty Advisor: Kimberlee Entsminger, Ph.D.

Vibrio cholerae, the causative agent of two of the seven recorded cholera pandemics, is a facultative anaerobic, gram negative bacteria. The main pathogenic effect is life-threatening acute diarrhea that cannot be helped by rehydration or electrolyte therapy. The most common treatment of cholera, like many other bacteria, is through the administration of antibiotics. Vibrio Cholerae, like many bacteria, is developing a resistance to classic antibiotic treatments, which is why the innovation of new treatments is necessary. Virstatin is a compound that takes a new route to treating V. cholerae by inhibiting ToxT, a transcription regulator. The synthesis of virstatin is completed in two steps. The first step of the reaction is a Gabriel synthesis that uses DMF as its solvent. Dimethyl formamide (DMF) is a toxic solvent that does not have any known replacements in reactions like the one being performed. The goal of the current experiment is to green the synthesis of virstatin by discovering a satisfactory benign alternative solvent to DMF. To do so three solvents will be tested for applicability: DMC (dimethyl carbonate), CPME (cyclopentyl methyl ether), and ethanol. Purity of product, percent yield, and reflux time were taken into account to determine the applicability of each solvent. The purity of the product was determined by NMR, IR, and melting point. TLC was used to monitor the reaction with 1:1 ethyl acetate: hexane as the mobile phase.
HONORS

Honors
“Effects of Creativity on Stimuli Recognition in Clouds”
Shannon Kelly, Suzanna Stapler, Meredith Edwards, and Taylor Brown
Faculty Advisor: Lonnie Yandell, Ph.D.

As a species, humans frequently personify elements of their environment. Scientists call this tendency pareidolia (Webster, 2011), a phenomenon that causes random or vague images to hold meaningful visual content for their observers. This may lead one to consider why some people notice figures in the clouds, for instance, while others do not. This experiment was designed to see whether creativity is a factor. The data was collected from 15 students of ages 18-22 in an Honors Science Analytics course at Belmont University. The procedure began with the students being asked to document images they found in cloud formations shown in a four-minute prepared video. The two variables closely examined in their responses were the specificity and the number of responses recorded by each student. They were then asked to answer questions used to measure their creativity levels. A comparison was made between the creativity data and the cloud response data. It was hypothesized that more creative students will have a greater ability to recognize a larger quantity of more specific figures in the cloud formations than less creative students. The findings, conversely, presented little-to-no relationship between the creativity data of the questionnaire and the responses to the clouds in the video that was shown.

Honors
“The Effects of Sound Perception on Shape Identification”
Dora Mae Geving, Sean Grossnickle, Mackinna Hart, Alex Lachmandas
Faculty Advisor: Lonnie Yandell, Ph.D.

When looking at series of words associated with a figure, people often assume there is no relationship. However, when the sharpness of a figure is modified to match the sharpness of a word a connection between the two can be found. This phenomenon is known as the baluma-takete effect (1929), and is defined as a mutual relationship between the sound of speech and the visual component of an image. Fox (1935) believed that an intrinsic connection existed between an object and the name assigned to it and demonstrated at its most basic form by rounder shapes being assigned a name of a softer sounding nonsense word. In attempting to replicate Fox’s study, our study tried to determine whether sharp figures would be related to more sharp-sounding letters and that less sharp figures would be related to more soft-sounding letters. Sixteen undergraduate students from a Belmont University Honors Science Analytics course, with ages ranging from 18 to 22 years, participated. They were presented 12 figures, which were either predominately sharply shaped (75% sharp corners) or more rounded shapes (75% rounded shapes). For each figure, they could choose among four nonsense words, two of which were sharp sounding and two round sounding as its name, and give a brief explanation on their choice. This study expects that the sharp or soft sounding words will be chosen as names for the sharp or round figures, respectively.
Repeated exposure to a word over a short period of time can often lead to a cognitive failure to connect the word to its meaning—a phenomenon called “semantic satiation.” In experiments related to semantic satiation, researchers will use auditory, visual or audio-visual stimulation in order to induce the phenomenon in participants. It is expected, therefore, that the more exposure the subject has to the word, the more likely a word is to be satiated and its meaning obscured, making audio-visual stimulation the most efficient means of semantic satiation. Fourteen undergraduate students of ages ranging from 19 to 22 enrolled in an Honors Science Analytics course were randomly assigned to three groups—audio, visual and audio-visual—and subjected to three rounds of semantic satiation and word-association tests. Each rotation consisted of a series of word-association questions to gauge comprehension and repeated exposure to the word either auditorily, visually, or audio-visually, followed by another word-association test. The participants’ answers and reaction times in the word-association tests were recorded by researchers, and compared before and after satiation. Contrary to expectations, the results of these trials did not point toward any method satiation being the most efficient means of creating distance between words and their meanings.

The McGurk effect occurs when an audible syllable (such as “ba”) is perceived at the same time as facial movements corresponding to a different syllable (“fa”), resulting in a misperception of the audible stimuli (McGurk & MacDonald, 1976). This study sought to explore whether changing the speed of the audio and visual stimuli affected the syllables perceived. The 15 participants, aged 18 to 22, were students in an Honors Science Analytics class at Belmont University. Participants were randomly assigned to three groups, with each of the groups watching separate 30-second videos that presented a female repeatedly saying “ba”. Once half way through the video, the female’s mouth moved to produce “fa” but the sound stayed as “ba”. The videos varied how fast the words were repeated, either at a slow (20 bpm), medium (70 bpm), or fast (120 bpm) speed. Participants identified what syllables they heard as the video progressed. We predicted that the faster the stimulus was presented, the stronger the McGurk Effect would be present (hearing something other than “ba”). Due to the small amount of participants, the frequency that participants heard something other than “ba” was not significantly different between groups. This study could lead to further studies to better understand the perception of language.
Ambiguous figures are images that can simultaneously be perceived in two different ways. Affective states in individuals can change the way ambiguous figures are perceived (Sakagami, 1999). Additionally, musical stimuli meant to affect a fearful emotional state can increase the likelihood of perceiving a threatening interpretation of an ambiguous figure (Prinz & Seidl, 2012). We are curious if this effect only occurred with auditory stimuli or if visual stimuli could have a similar influence. Sixteen undergraduate students, ranging in age from 19 to 22 years old and who were enrolled in a Belmont University Honors class, were randomly assigned to one of two groups. One group was shown a series of five happy pictures and the second group was shown a series of five threatening pictures before being asked to interpret a set of four ambiguous figures. It was expected that the threatening pictures group would consistently choose the threatening interpretation of the figures, and that the happy pictures group would consistently choose the neutral interpretation of the figures. This would demonstrate that affective visual stimuli can influence perception of ambiguous figures.
The world of data science has grown exponentially leading to large companies scrambling to acquire new talent for their analytics departments. In the sports world, one can see that every major league sports team has built some form of an analytics department as they try to gain a competitive edge. The NFL Combine has been around for almost 20 years now. This project will consider data from the 1999 trials to the present. Using tools to scrape, 'prettify', and parse the data, trends may emerge to show how performing well in different areas of the combine can predict the future success of a player. Overall, with Wonderlic scores and forty yard dash times, along with several other measures, the intent is to find some form of correlation that gives clues for a successful prospect by position. Using this data, the performance in the combine can be utilized to characterize athletes while also providing information on which events are more statistically relevant across the positions. Due to the random nature of players’ responses after the combine it can be hypothesized that these correlations may only offer slight indications. One main focus will be how Wonderlic scores relate to quarterback success. The Wonderlic is essentially an intelligence test for players (mainly quarterbacks). The importance of this score in the combine has been under scrutiny. Through comparing quarterback starts, wins, and Wonderlic scores, data analytics provides the tools to answer these sorts of questions, along with many others.

For our project we will be making a machine learning audio program. The program will be doing supervised learning in order to determine the difference between a kick drum and a snare. Our first step is to make a data frame of audio signals. We are converting the audio files into a signal objects in a class we made call signal.py. Our data frame will be made of these signal objects, which are a three dimensional array that describes frequencies at any given “buffer”. The number of buffers is determined by the length of the audio and its sample rate. The buffer will contain a list of frequencies at that time for the specific audio signal object. We are also normalizing every track to ensure a fair comparison. Our eventual goal with this project is to do something like Google’s DeepDream project, a program used for image recognition, but with audio. Ideally we could create a plug-in for a DAW, like protools. However, before we attempt that lofty goal we would first like to make something that works. That is why we are trying to make a program that just does supervised learning on our signal objects before we try to create something comparable to DeepDream.

For our end of semester project, we will be expanding upon the Connect 4 game we attempted for week 5 games homework. In our original submission, we experienced a few game-breaking pitfalls. First the agent was not intelligent, and always selected the column farthest to the left. We believe this restriction arose from the gravity implemented on the board. Another major shortcoming of the original submission was the reliance upon GameStates. Because there are 4,531,985,219,092 possible states, with 2,626,652,048,471 non-winning states and 1,905,333,170,621 winning states, it is essentially impossible to write them all. We therefore must create an algorithm that implements alpha-beta pruning in order to successfully create a smart agent. Lastly we never implemented heuristics into our
search algorithms. Without good heuristics, the agent will inevitably make poor decisions throughout the game.

John Tromp created the first algorithm to brute force solve Connect Four using minimax and alpha-beta on February 4th, 1995, and we will be modeling our solutions off of his completed work. We will be using minimax with alpha-beta pruning, as this is the search algorithm that will be the hardest to beat. We will be creating an intuitive UI that will make it easy for the user to play the game.

Mathematics and Computer Science
“An Interactive Sudoku Game and Problem Solver”
Sean Conklin and Andy Porter
Faculty Advisor: William Hooper, Ph.D.

For our group project for the semester, we are going to build upon the fundamental concepts of Artificial Intelligence that we learned about in this course by building a fully playable sudoku-esque game, complete with a Classical Search Problem-based solver. For the game itself, we plan on making a sudoku-esque game with varying levels of difficulty that correlate to the size of the board (ie: easy would be a 4x4, medium would be around 9x9, etc…). We plan on providing a fixed percentage of answers for all instances and leaving the rest as empty spaces taking user input to replicate the procedure of the on-paper game of sudoku. Given these different game state board sizes, we figure that this will in turn create varying levels of difficulty for our sudoku solver algorithm, which in itself will be used as a way to complete the puzzle if the user is stuck, much like any other online sudoku game. Furthermore, while we plan on making a few basic game-states with varying levels of complexity, we expect our project to be able to correctly solve any reasonable puzzle thrown at it. To do this, we plan on having a section in the code dedicated to storing different sudoku puzzle instances that can be easily manipulated by the user to create a brand new puzzle. Since we do not have a finalized title for our project, we are temporarily referring to it as “Sudok-You”.

Mathematics and Computer Science
“Alphametric Problem Solver”
Zayne Anderson, Joe LaMartina, and Grant VanderKallen
Faculty Advisor: William Hooper, Ph.D.

Throughout this project we hope to investigate further the logic behind an alphametric problem. These problems were brought up briefly during our class time, so clearly they are a good example of how AI can be implemented to outperform human production. Alphametric problems involve a sort of cryptic statement, where letters need to be assigned a unique number that creates a valid numerical statement. To start, this project would involve simple searching and backtracking to solve problems as they are given, but it will mature into either creating better heuristics or involve logical statements to improve performance beyond a “guess and check” format. In either case this would provide a robust coding that could solve alphametric problems much faster than a casual user could. Alphametric problems are relevant to the subject and are even used in Dr. Pinter’s monthly problem sets, so a deeper understanding on what it would take to code a solution maker could be of interest. This project would also include an interactive portion where a user would be able to create a new alphametric problem for our problem solver to find a correct solution to. This code should then be able to provide reasonable responses even if the user input was of an unsolvable alphametric problem (or a problem that has multiple answers).
Teeko is a two player abstract strategy game, invented in 1937 by John Scarne. Its board is a 5 x 5 checker board, and each player has 4 pieces at their disposal. The game has two different win-conditions; to get either 4 pieces in a diagonal, vertical, or horizontal row or to arrange the player’s four pieces into a square. What makes Teeko unique is that the game has two distinct phases, one that resembles tic-tac-toe, and another that resembles checkers. The players take turns placing pieces. Once all pieces are on the board, the players then take turns moving one piece into an adjacent square on the board, until one player has either arranged his pieces into a row of 4, or into a square.

For this project we will use an alpha-beta pruning search algorithm to generate the next best move for the ai player. We will test the ai by setting up close to win scenarios in which the ai should pick the best next move. We will also compare alpha-beta to other search algorithms to justify why alpha-beta is the best technique for this particular game environment.

In this project, we will be examining various implementations of search algorithms and heuristics in a classic 2 person game environment. The 2 person game we will be using is Pente. Using Pente, we will attempt to exemplify various search algorithms that reach the goal in the most efficient way. Also, Pente is a great way to implement a functioning and effective heuristic. We will explore both of these components and decipher which methods are best when trying to win the game. The goal of Pente is to align 5 stones of the same color in a vertical, horizontal or diagonal in a line. It is a 2 person game where each player is represented by different game pieces. The most common and classic game pieces, but not limited to, are black and white stones. The smallest game environment is a 5 by 5 board but can range from any size.

The goal of this project will be to utilize the aforementioned search algorithms in order to create code that will achieve a high-level of playing in the game Pente. We estimate that this will require for the program to be aware of the placement of its pieces and to always select the available move that is the closest their own pieces. The projected goal of this project can be defined within a few points: the program must be able to solve various stages of the game board, it will have the ability to defeat the average user, it must demonstrate resilience in response to the opponent, and the game and its outcome will be useful in explaining the used algorithms and the importance of an effective heuristic.
Our goal for this project is to experiment by implementing different heuristic functions, and reporting our findings of those functions’ implications. We will limit our look-ahead depth so as to mimic human play and produce results in a reasonable amount of time. The first heuristic we will examine simply chooses the first valid move (going from left to right). The second heuristic we will examine simply prioritizes moves that will give the player an extra turn. The third heuristic that we will examine prioritizes moves which will acquire opponent’s stones. The fourth heuristic we will examine is one which doesn’t require look-ahead at all. It counts how many pieces will pass a player’s “home” pit, and prioritizes moves which will have fewer pieces pass a player’s “home” pit, making those pieces safer from capture. Combining these heuristics in different ways should yield even fewer losses. We will also try to come up with our own heuristic(s) and combine them with the other heuristics. We will compare these results of AIs using these heuristics with AIs using minimax searches and techniques like alpha-beta pruning. We will pit two programs with differing heuristic functions against each other as well. The initial game state will have 14 total pits, four stones contained in each pit except for each “home” pit, which will contain 0 stones each. We will analyze notable moves, games, average win/loss ratios, and report these findings.
Social media is becoming more prominent in everyday life, with 78 percent of the United States population currently having a profile on a social media account (Statista, 2016). Potential concerns arise with such a large use of social media. For instance, previous studies have investigated the tendency of individuals to compare themselves to the content they observe on social media. Vogel, Rose, Roberts, and Eckles (2014) found a negative relationship between frequency of Facebook use and self-esteem. In the present study, the hypothesis predicts that viewing others’ social media profiles that portray positive social activity causes the user to feel a more unpleasant mood than viewing profiles that portray a negative social activity. Fourteen Belmont University students were randomly assigned to two different groups, each observing 35 slides containing content from social media accounts. The slides contained positive content, such as life achievements, as well as negative content, such as being stressed. One group observed slides with 75% more positive content than negative content, and the other group observed slides with 75% more negative content than positive content. After the presentation, participants rated their overall mood using the John D. Mayer Brief Mood Introspection Scale (BMIS). A t-test indicated that while the positive content group showed lower mood than the negative content group, the difference was not statistically significant. While the results of this study leaned in favor of our hypothesis, further research with a larger sample size may be helpful.

Individuals from different cultures consume beverages that range in flavor profile from bitter to sweet. Sagioglou and Greitemeyer (2014) found that the consumption of bitter beverages increased hostility in making moral judgments and decisions. Chapman, Kim, Susskind, and Anderson (2009) discovered that the consumption of sweet beverages lead to a less caustic judgment of morality. We hypothesized that the consumption of a bitter beverage would yield a more critical moral judgment, and that the consumption of a sweet beverage would yield a more positive moral judgment. Fourteen undergraduate students ranging in age from 17 to 29 enrolled in a Research Methods course were all randomly assigned to one of three beverage options: black coffee (bitter), sweet tea (sweet), and water (control). The participants each ingested their given beverage and completed a series of vignettes specifically written to illustrate situations of questionable morality. A comparison between the mean moral judgement scores of the three groups revealed that the bitter taste group had a higher morality score (indicating more critical judgement) than the sweet taste group or the water group. These findings indicated that our hypothesis was partially supported and that bitter beverages did result in more critical moral judgments, but sweet beverages did not result a more relaxed moral judgment.
College students keep their Facebook information more appropriate than their Twitter information. They may believe future employers and family members view Facebook as more appropriate than their Twitter, which they believe is mainly viewed by peers. The purpose of this experiment was to see how students want themselves to be perceived on Facebook versus Twitter. The study began by investigating what college students deemed to be a respectable picture to post on either Facebook or Twitter and how likely they would be to post it on either platform. There were 15 participants: 12 women and 3 men from our Research Methods class. The age range was 17-29. The pictures, which were previously deemed socially appropriate or socially inappropriate by the researchers, were judged by each student using a Likert scale, 1 (very unlikely) to 5 (very likely) to be likely posted on Facebook or Twitter. The results suggested that college students were more likely to choose the more conservative pictures to post on Facebook and the less appropriate pictures on Twitter. Our data showed that the socially appropriate pictures were likely to post on Facebook and Twitter, but the socially inappropriate pictures were least likely to post on either. Consequently, the hypothesis was only partially supported.

Color is an impactful component of daily life given its ability to elicit emotional responses. Researches have found a relationship between word association to a certain color (Wexner 1954) and a color’s ability to provoke multiple responses (Kaya 2004). We sought to determine if color preference had a significant impact on mood. Fourteen participants, aged 17-20, were presented 32 slides that displayed 8 colors through 4 different stimuli, and were asked to select a word from a provided list of 22 words that best represented their emotional response to each stimuli. We predict that a preferred color will result in more positive emotions despite varied presentations of the color and a least preferred color will result in more negative emotions.

Music plays an integral part in our emotions. Argstatter (2016), Boltz, Schulkind, and Kantra, (1991), and Daly et al. (2015) have suggested that music elicits emotional responses dependent upon the sound perceived. Our study expanded upon those ideas with focus upon sound frequency (Hz), defined as the rate of sound wave vibration. We hypothesized that an emotional fear response to sound frequency would increase as the Hz rate increased. Participants, consisting of 15 male and female Research Methods students at Belmont University with ages ranging from 18-33, were asked to read a scenario designed to potentially elicit fear. While reading the scenarios, they listened to one of three different ten second interval tones with one of the following frequencies: Low 80.1-320 Hz, Medium 320.1-1,260 Hz, and High 1,260.1-5,000 Hz, and rated their fear on an adaptation of the Fear Questionnaire developed by Marks and Mathews' (1979). Our results may contribute to a higher understanding of how frequency in music is related to emotional response.
ORAL PRESENTATIONS  
(Simultaneous Sessions)  
JAAC 5th Floor | 5:30PM-7:30PM

PSYCHOLOGICAL SCIENCE

JAAC| Room 5003  
Moderator: Patrick Morse, Ph.D.

5:30PM  
Psychological Science  
“Acknowledgement of One’s Own Racial Biases Effect on Group Selection”  
Candace Hearn, Maeve Fitzpatrick, Allison Ramsey, and Ellyn Webster  
Faculty Advisor: Patrick Morse, Ph.D.

There has been a lot of racial tension in the air for the past few years. From the fatal shootings of African Americans by police officers, to the current presidential election, it is obvious that some people are unaware of their unconscious racial biases. In a study conducted by Kao (2000), it was discovered that between 4 racial groups (Blacks, Whites, Asians, and Hispanics), Whites and Asians are thought to be more academic and successful when compared to Blacks and Hispanics. According to Tan et al. (2001), peer groups do influence one’s racial attitudes and stereotypes and people tend to choose friends who are like them. The current study will investigate how becoming aware of one’s racial biases will affect group selection in undergraduate students. Participants will rank stereotypical names from the 4 racial groups in the likelihood of wanting each person in their academic or social group. They will be primed with the Race IAT in between the two name ranking tasks. We predict that after being primed by the Race IAT, the participants will have more diverse names ranked higher on their second name ranking task. We also predict that the participants’ unconscious racial biases will appear in their first name ranking task. Results indicated that there were no significant differences between the groups. Group selection in different situations may not be affected by implicit biases, even after being primed to those biases.

5:45PM  
Psychological Science  
“The Art of Kindness: The effects of interpersonal compassion on self-compassion”  
Kathryn Dickenson, Paige Robinson, Rachel Holloway, Monica Anis, and Alejandra Cota  
Faculty Advisor: Patrick Morse, Ph.D.

Self-compassion is treating oneself with self-kindness, common humanity, and experiencing mindfulness (Neff, 2003). We questioned whether there is a way to elicit self-compassionate behavior by first being compassionate towards another person. We administered a memory test in which every participant was falsely told they scored below average. Afterwards, the experimental group was given a writing prompt priming them for compassion while the control group was given a neutral prompt. Then, both groups of participants completed a state self-compassion survey. We anticipated that the experimental group would score higher on levels of self-compassion than the control group. We also hypothesized that men would score higher on self-compassion across both groups of participants. We administered an independent sample t-test to analyze the effect of the manipulation and the results displayed a p-value of .824. This indicated that there was no significant difference in self-compassion between the control and experimental conditions. Another independent sample t-test was administered to analyze gender differences and self-compassion scores. The p-value was .965, indicating there was no difference in self-compassion scores between males and females. Future studies should continue to explore state self-compassion alongside trait self-compassion. More research should also include longitudinal designs to test state self-compassion. Future research should display how self-compassion can be used to create a healthy reaction to everyday life challenges.
**6:00PM**  
Psychological Science  
“The Impact of Gender Stereotypes on Empathic Accuracy”  
Amber Lowe, Ragan Wilson, Marie Holzer, Janai Todd  
Faculty Advisor: Lonnie Yandell, Ph.D.

Gender stereotypes, which involve differences between men and women, are especially widespread and have a pervasive influence (Klein and Hodges, 2001). Women are generally stereotyped as being more sensitive and emotional, while men are stereotyped as being less sensitive. Empathy is the ability to gauge the emotions of others, and empathic accuracy is how correct a person is in performing that task (Ickes, 1993). The purpose of this study was to examine the impact of gender stereotypes on empathic accuracy. 59 participants (45 women and 14 men) from Belmont University completed a stereotype priming task, performed an empathic accuracy task, and were given a survey measuring empathy. For each gender, participants were assigned to either a gender-congruent (ideas usually associated with the participant’s gender) or gender-incongruent (ideas not associated with the participant’s gender) stereotype condition. Participants performed the corresponding priming task, which was derived from Blair & Binaji (1996). Presented through a timed PowerPoint, participants saw a series of either empathetic or non-empathetic adjectives paired with gendered names and indicated how well the adjectives and names sounded together. Participants then completed the Revised Eyes in the Mind Task (Baren-Cohen, Wheelwright, Hill, Rape & Plumb, 2001) to measure empathic accuracy; participants were shown 36 images of different pairs of eyes and chose the emotion that best corresponds to the image. Lastly, participants completed an empathy survey, acquired from Barchard (2001), which featured 10 Likert-type items. Results do not show any significant interaction between gender and empathic accuracy. The weakness of our priming task and the low sensitivity of the empathic accuracy task likely impacted the results of our study.

**6:15PM**  
Psychological Science  
“Social Desirability and Maladaptive Humor”  
Brittany Lebhar, Kyle McLean, Stephane Morin, Rosaline Prophete, and Michael Rasille  
Faculty Advisor: Patrick Morse, Ph.D.

Use of humor is widespread across identities and cultures. How humor is displayed can vary largely and affect every day social interactions. Our experimental study examined whether subjects with maladaptive humor styles and adaptive humor styles view the social desirability of a maladaptive joke in a social situation similarly. Participants’ categorization of humor style is determined by completion of a Humor Style Questionnaire determining each participants as having an adaptive humor style or maladaptive humor style. Participants read a scenario displaying the use of a maladaptive joke and received differing feedback that was categorized as negative or positive. Positive feedback included fictional characters laughing along with the joke, and negative feedback included silence after the presentation of the joke. Research was collected from participants all above age 18. The use of an ANOVA tested for an association between the independent variable, feedback regarding a maladaptive joke, and the dependent variable, level of social desirability recorded. Our results suggested those with maladaptive humor judged the social desirability of a maladaptive joke favorably, while those with adaptive humor have an inverse relationship with acceptance of a maladaptive joke. These results can be used to further examine the effects of humor styles on social interactions. Furthermore, humor can behave as a natural discourse for contentious topics. In finding common ground through humor, certain topics that may be seen as taboo can be openly discussed. However, understanding people’s humor styles, as well as the context with which to bring up a certain joke, can be extremely important when traversing the tricky landscape of what is considered to be humorous.
6:30PM
Psychological Science
“Virtual Reality and Narrative”
Sydne Richardson, Thomas Diez, Kyle Bailey, David Vogel
Faculty Advisor: Lonnie Yandell, Ph.D.

Immersive virtual reality headset devices are a growing technology sector for education and home entertainment. These devices offer unique types of sensory experiences to those that use them. Thus, there may be important differences in the psychological effects of exposure to virtual reality scenarios compared to other existing narrative or interactive formats. Previous research has suggested that individuals’ prosocial reasoning increases when exposed to a virtual reality ethical scenarios. Also, research has found an association between higher intensity of mental visualization and increases in prosocial reasoning elements such as empathy. If the immersive visual presentation of virtual reality is able to elicit more powerful emotional connection and perspective-taking in participants, it may have have important implications on narrative and interactive storytelling in the future. The present study examines virtual reality narrative and how it affects individuals’ level of prosocial reasoning. 51 participants were recruited from the Belmont University psychology undergraduate recruitment system. Participants were exposed to the same narrative story in one of three formats: virtual reality (17 min.), traditional video (17 min.), and written text (1400 words). They were then given the Prosocial Reasoning Objective Measure (PROM) survey (Carlo, Eisenberg, & Knight, 1992), an existing measure of prosocial reasoning. No significant effect was found for method of presentation on prosocial reasoning. Future research could examine effects for interactive virtual reality programs in addition to passive, narrative experiences. Also, research can examine whether immersive virtual reality perceptive experiences enhance mental visualization or if they replace or interfere with the mind’s own mental imagery.

6:45PM
Psychological Science
“Conformity: Private Attitudes and Public Intentions”
Piper Cleveland, Quinn Forrer, Eric Patterson, Cille Taylor
Faculty Advisor: Patrick Morse, Ph.D.

The present study assessed the extent to which people’s private attitudes match their public intentions when exposed to the beliefs of their peers. Previous research has stated that an individual is less likely to display their attitudes when peers disagree to what they believe (Hornsey, Majkut, Terry, & McKimmie, 2003). For our study, we hypothesized that when individuals believe that their peers do not agree with their attitudes, they are less likely to hold public intentions than when they do not know what their peers believe. When individuals believe that their peers do agree with their attitudes, we hypothesize that they are more likely to hold public intentions than when they do not know what their peers believe. For this study, participants provided their attitudes on various moral topics (e.g., gay marriage), were then exposed to false statistics regarding their peers’ attitudes (that either supported or contradicted their beliefs or that were inconclusive), and then indicated their likelihood to display their attitudes publicly. Results suggest that individuals are less likely to display their attitudes publicly when they believe that their peers disagree with them then when they are not shown any data. However, our hypothesis that individuals are more likely to display their attitudes when they believe that their peers agree with them or when they are not shown any data was not supported.
There is extensive research on the feelings of one person’s interest in another individual, known as interpersonal attraction. However, limited literature exists examining physical attractiveness, one component of interpersonal attraction, with biographical memory recall. The researchers examine the potential relationship between gender and physical attractiveness of a face on an individual’s ability to recall biographical information about that person. Researchers hypothesized that more information will be recalled about more physically attractive faces than less physically attractive faces. Participants in this study consisted of 129 Belmont University undergraduate students. All participants gave informed consent and were assigned to one of four conditions: more attractive female, less attractive female, more attractive male, and less attractive male. Researchers used an online face database, in addition to Google Images, to find four faces which matched these conditions. These faces were paired with an identical 300 word description of a hypothetical individual named Alex. The Interpersonal Attraction Scale (IAS; McCroskey & McCain, 1974) measured participants’ ratings of physical attractiveness of the face. A 2 x 2 analysis of variance (ANOVA) conducted on two independent variables (physical attractiveness level and gender of the face) indicated a main effect for physical attractiveness, $F(1,125) = 29.25, p<.001$, thus supporting the researcher’s manipulation of physical attractiveness. A second 2 x 2 ANOVA was also conducted for the interaction between the same independent variables on the amount of biographical information correctly recalled, $F(1,125) = 2.32, p>.05$, which does not support the researchers’ hypotheses.

Perfectionism is a multidimensional construct consisting of both maladaptive and adaptive characteristics which affect many people’s school and work lives. Maladaptive perfectionism involves high and potentially unhealthy levels of performance expectations, finding self-worth in success, working to please others, and worrying about others’ expectations and opinions of oneself (Hewitt & Flett, 1991). A number of existing measures of perfectionism examine both maladaptive and adaptive perfectionism, yet no independent measure specifically examining maladaptive perfectionism exists despite its powerful implications for personal success and health. The goal of the present study was to create and validate a new measure of maladaptive perfectionism, the Belmont University Maladaptive Perfectionism Scale (BUMPS). We hypothesized that (1) the BUMPS will have construct validity in the form of convergent and discriminant validity and (2) the BUMPS will have inter-item reliability. 105 undergraduate students (81 women, 24 men) recruited from introductory psychology courses at Belmont University completed a battery of questionnaires measuring maladaptive perfectionism, neuroticism, resilience, and optimism. The BUMPS demonstrated convergent validity with the Multidimensional Perfectionism Scale (Hewitt & Flett, 1991; $r = .71, p < .001$) and with a neuroticism measure ($r = .44, p < .001$) and discriminant validity with a resilience measure ($r = -.30, p < .005$) but not with an optimism measure ($r = -.14, p > .05$). The BUMPS also demonstrated inter-item reliability ($\alpha = .76$). These results support the validity and reliability of the BUMPS as a measure of maladaptive perfectionism.
Overconfidence, method of viewing faces, and memory accuracy retain a confusing relationship because of contradicting findings in the literature. Higher confidence is generally associated with greater accuracy in facial memory tasks due to belief in the reliability of eyewitness memory and trust in one’s own intuition (Wixted et al., 2015). Method of presenting faces also affects recognition accuracy. When a lineup is displayed simultaneously, confidence becomes a strong indicator of accuracy (Wixted et al., 2015). However, other studies have viewed confidence as a weak indicator of identification accuracy (Weber & Brewer, 2006). The present study aims to evaluate the relationship between facial recognition confidence, method of presenting faces (simultaneously or sequentially), and facial recognition accuracy. It is hypothesized that both simultaneous lineups and confidence priming will result in higher facial recognition accuracy. 95 Belmont University students were divided into four conditions by two independent variables: presence of confidence priming (confidence vs no confidence) and method of viewing faces (simultaneously vs sequentially). The participants were primed for two conditions (confidence or no confidence). Then standardized faces were shown either simultaneously and sequentially for each primed condition. Faces were removed, then participants were tested on their accuracy at recognizing some of the previously seen faces. Results indicated sequential viewing, but not confidence priming, resulting better recognition than simultaneous viewing, which does not support the researchers’ hypotheses. However, an interaction between method of viewing faces and presence of confidence on recognition accuracy was found, and supports the researchers’ hypotheses.

Nonconscious behavioral mimicry results from the nonconscious perception of behavior and an automatic social behavioral response and functions as a mechanism to meet our human need to belong (Chartrand & Bargh, 1999). While research has examined the influence of factors such as pride, social exclusion, guilt, and gratitude on nonconscious behavioral mimicry, no current literature has investigated the impact of shame on nonconscious behavioral mimicry. The current study aimed to contribute to existing literature about how one’s disposition may affect their likeliness to mimic another’s behavior. We hypothesized that participants primed to feel shame would express greater nonconscious behavioral mimicry than those not primed to feel shame. Participants responded to a randomly assigned writing prompt about either their greatest failure (the experimental condition) or a neutral memory involving food (the control condition). They then watched a short video of a confederate engaging in ten scripted behaviors, and the researchers recorded the number of behaviors that the participants’ mimicked. Results indicated no significant difference in the amount of nonconscious behavioral mimicry between participants primed to feel shame and participants not primed to feel shame (t(53) = .789, p = .434). Further research is required to better understand the relationship between feelings of shame and nonconscious behavioral mimicry.
Harmonious music has shown to have a direct effect on testing performance. A study by Perlovsky and colleagues (2013) showed that students taking an academic test obtained better results when listening to pleasant music as compared to a silent environment. When the tone of a specific song matches the tone of a task at hand, they are said to be harmonious or congruent. Our study aimed to investigate if the congruity of music material learned has an impact on memory and learning. Sixty-nine undergraduate students ranging from age 18 to 56, were randomly assigned to either a control, congruent, or incongruent condition; the control condition having no music playing, the congruent condition consisting of music determined happy, and an incongruent condition consisting of music that generally elicits negative emotions. On a screen, each participant viewed 20 words - 10 positive and 10 neutral - for 55 seconds before being asked to recall. We hypothesized that participants who learned the list of words in the congruent condition would recall more words than the incongruent and no music conditions, and that participants in the congruent condition will recall the positive words more readily than the other conditions. The results showed no statistical difference between the control, congruent, and incongruent conditions. Further studies on music and word recall are necessary to understand how music impacts cognition.

Facial expression is an essential nonverbal cue used in communication. According to the facial feedback hypothesis, the imitation of a speaker's facial expression can be used by the receiver to communicate empathetic feedback (Carr & Lutjemeier, 2005). Empathy is the understanding of and responding to emotional states of others and is, therefore, also an important component of communication within interpersonal relationships (Zaki, Bolger, & Ochsner, 2009). The facial expression of the presenter should have a stronger impact on the receiver's facial expression than the expression of the written story, itself. We expect that the receiver would feel more empathetic towards stories told with congruent facial affect, as opposed to those told with incongruent facial affect. Sixteen Belmont University male and female students, enrolled in introductory psychology courses, were presented with a sequence of four slides, in four separate conditions. Congruent conditions were those in which the emotional expression of the story matched the expression of the image that it was paired with, and incongruent conditions were those in which the expressions did not match. Participants reported greater situational empathy when the facial affect was congruent with the expression of the story, compared to the incongruent trials. There was no evidence that the facial affect of the “narrator” (animated image) had a stronger impact on the self-reported situational empathy than the expression of the story, or message, itself. These results indicate a need for further research.
Previous studies have shown that music has the ability to increase learning and enhance memory performance (Hallman, Price, & Katsarou, 2002). Furthermore, a study performed by Cookerton, Moore & Norman (2002) suggested that the type of music listened to has a role in memory and learning performance increase. For this study, our goal was to determine whether rats exposed to classical music during maze training would learn the maze faster than rats not exposed to music, and if rats exposed to music in their home cages would learn the maze faster than rats not exposed to music. Before the start of the experiment, 21 rats were habituated to their environment for 7 days. They were then randomly assigned to three groups: control (no music), maze music group and home music group with 7 rats in each group. Four rats randomly selected from each group were used for the experiment. Prior to each trial, the rat was food deprived for 24 hours. During the trial, each rat from each group was put in a maze and had up to five minutes to locate their reinforced goal box. Each rat had 3 five-minute trials for a week. Results were measured based on how long it took them to reach the rewarded goal box starting from the start box in the y-maze. Our hypothesis was not supported because the control group actually learned quicker and faster compared to the maze music group and home music group.

This study gathered evidence of reliability and validity for a new measure of delay of gratification specifically oriented to undergraduate college students. Researchers hypothesized that the new measure of delay of gratification, the Situationally-Oriented Survey of Delay of Gratification (SOSDOG) would be a reliable and valid way to measure delay of gratification in the population of young adult college students. Construct validity was assessed through means of convergent and discriminant validity measures in addition to a behavioral measure. Sixty-seven participants were recruited from Belmont University's online recruitment system, and participated in completing four questionnaires along with fulfilling a behavioral assessment. Statistical analyses found some evidence for reliability and validity of the new measure. These include correlates with a measure of delay of gratification, GPA, a measure of self-control, and a measure of impulsivity. Correlates with behavioral observation gave no evidence of validity to either the SOSDOG in total or the technological subscale.
Studies have indicated that stereotypes based on race and age have significant effects on speech perception. When we are faced with an incongruent combination of stereotype and stimulus (ex. a Caucasian person speaking with a Mandarin accent), we struggle to understand it more than if we are faced with a congruent combination (a Chinese person speaking with a Mandarin accent) (Atkinson, 2016; McGowan, 2015). The current study examined the effects of gender stereotypes on speech perception. We hypothesized that participants would make more errors when transcribing a script with an incongruent combination of a stereotypically gendered topic and the gender of the speaker. Fifty-five participants (14 males and 44 females) ages 18 to 22 from introductory psychology course students from Belmont University participated. Participants were asked to transcribe two recorded scripts that each discussed either a stereotypically male topic or a stereotypically female topic; one script discussed shopping at different kinds of stores and the other discussed different sports. There were two conditions. In one condition, participants heard the recorded scripts read by a female speaker. In the other condition, participants heard the recorded scripts read by a male speaker. No significant differences between groups were found, but further research is warranted.

The purpose of this study was to evaluate the reliability and validity of a recently developed scale that measures entitlement. This scale is called the Academic, Relational and Occupational Entitlement Scale (AROES). Other scales have been generated to measure overall entitlement, but to our knowledge no scales have been developed that measure different dimensions of entitlement in addition to overall entitlement. Our new scale is a multi-dimensional scale that generates a general entitlement score as well as three other scores that correspond to three different dimensions of entitlement. We hypothesize that our measure of entitlement, the Academic, Relational and Occupational Entitlement Scale, will have construct validity, in the form of convergent and discriminant validity, as well as inter-item reliability. Our hypothesis was partially supported. We found convergent validity between AROES and two out of our three convergent measures but we did not find significant results for our third. We found discriminant validity for one of our discriminant measures, but not for the other measure. Our results also showed strong inter-item consistency. Future research is needed to further validate the AROES.

Mind body dualism is at the center of one of the oldest philosophical debates, which asks the question “what is the nature of the self?” Defined as perceiving one’s mind and body as two distinct entities, dualism advocates the separation of the self from the body. An opposing construct, physicalism, is the belief that the mind and body are inseparable. Recent studies have shown that when primed for dualism,
participants exhibit fewer positive health related behaviors, compared to those primed for the complementary construct of physicalism (Forstman, Burgmer, & Mussweiler, 2012). The present study investigates the impact of mind-body dualism on a specific health behavior, driving a car. We hypothesized that those primed for dualism will exhibit riskier driving behavior than those primed for physicalism. Thirty undergraduate students enrolled in an introductory psychology course were randomly assigned to either the mind-body dualism priming condition or the physicalism priming condition. In either condition, participants read a vignette describing either mind-body dualism or physicalism. Following the priming, the participants completed a driving simulation task, and the Risky Driving Behavior Scale (Falk and Montgomery, 2009) consisting of 21 items describing their driving behavior. We expect to find that those primed for dualism will exhibit riskier driving behavior than those primed for physicalism.

6:30PM
“The Development of a Measure of Interpersonal Dependency”
Allison Holmes, Marilyn Lauterbach, Seth Strobel, Krista Tice, and Matthew Williams
Faculty Advisor: Pete Giordano, Ph.D.

We sought to develop a new measure of interpersonal dependency called the Belmont Interpersonal Dependency Scale (BIDS). Only two other questionnaires exist for a normal population, namely the Interpersonal Dependency Inventory (IDI) and its brief version, the IDI-6. We hypothesized that the BIDS would have construct validity, in the form of convergent and discriminant validity, and would have inter-item reliability. We searched for convergent validity in our measure using the IDI-6 and the Brief Fear of Negative Evaluation Scale (BFNE). Our discriminant measure was the Medical Outcomes Survey 20-item Short-Form Health Survey (SF-20). The Miller Social Intimacy Scale (MSIS) was also given as a discriminant measure, as it had previously shown no correlation with dependency. Results indicated a significant relationship between our measure and the BFNE (r = .432, p = .007 when N = 38), the SF-20 (r = -.44, p = .008 when N = 35) and the MSIS (r = .35, p = .047 when N = 33). Our data revealed no significant relationship between our instrument and the IDI-6 (r = .26, p = .11 when N = 38.) Inter-item reliability for our measure ranged between .57 and .75, since multiple sample sizes existed. No relationship with the IDI-6 may suggest that our test lacks validity because it might not be measuring the construct of interpersonal dependency. Limitations in this study include the possibility of a student’s participation in multiple groups, the lack of male participants, and low sample sizes. More research is needed, particularly on the relationship between our test and existing parallel measures.

6:45PM
Psychological Science
“Stress and Sleep Correlational Study”
Andrea Franjic, Meghan McGath, Mikayla O’Malley, Florence Matthews, and Seth Strobel
Faculty Advisor: William Bailey, Ph.D.

The amount of stress a student goes through in college can have a tremendous effect on his or her sleep schedule. A recent study found that students have higher levels of stress and lower levels of sleep (Ari & Shulman, 2012). This study does not account for differences in circadian rhythm that could impact stress levels at a given time. Ari and Shulman have supported the findings of others that there is a relationship between sleep and stress. However, there are no current studies examining the correlation between whether a person self reports as a morning person or night person and stress level. Amount of sleep differs from morningness and can imply a different relationship between sleep habits and stress level or mood. Using a survey approach, our study will examine the correlation between results from a morningness scale and a stress scale. We hypothesize that the Stress and Sleep Scale will demonstrate a negative correlation between the morningness and scales. There was found to be a correlation between morning type people and lower stress levels, which supported our hypothesis.
To humans, sleep is arguably the most important regulated activity. For college student's homework, jobs, friends, internships, and eating are all priorities, but sadly sleep is not a priority. A study done by Sexton-Radek and Pichler-Mowry looked at the interaction between daily activities and sleep quality in young adults, and what they found was that the activities that the young adults engaged in, made them go to sleep later and when they slept it was for a shorter amount of time (2011). This is important because bad sleep habits can lead to an increased risk of obesity, cancer, or mortality (Megdal, 2007). Our study analyzed how a person's sleep patterns affects their motor skills. Participants received two surveys in a counterbalanced distribution in order to determine whether participants were a morning person or an evening person, and on average how much sleep they got. Participants also completed a photoelectric rotary pursuit motor task that timed how long they were able to remain on task. It is expected that those reporting a high quality of sleep are more likely to be a morning person, and these morning people will perform better on the motor task than those that report being an evening person. Going with that, it is also expected that those that report a better quality of sleep will also perform better on the motor task.

MATHEMATICS AND COMPUTER SCIENCE

JAAC| Room 5010
Moderator: Andy Miller, Ph.D.

5:30PM
Mathematics and Computer Science
“Linearization and Solution Approximations for Nonlinear Differential Equations”
Allison Hardee
Faculty Advisor: Daniel Biles, Ph.D.

Many nonlinear ordinary differential equations do not have an easily discoverable explicit solution. In order to learn more about these equations and their solutions, we can use linearization and assorted approximation methods, such as the Runge-Kutta numerical approximation and the Taylor series approximation, as guides to the nature of these solutions. By comparing these methods, we can achieve a greater understanding of how the solution behaves. In this talk, we will address a variety of nonlinearities and discuss the measures taken to better understand their solutions.
People organize themselves within complex social networks, and where they are in their social networks can have serious implications for how they view the world. This model aims to situate people within their social networks, so we can study how ideas travel within the network. Associated with each person is a set of linear ordinary differential equations representing the disposition of the person toward a certain aspect of an idea. For example, if we were modeling a presidential election, there would be a certain probability a person would lean toward the Republican, Democratic, Libertarian or Green Parties at any particular time. The goal of this research is to test the validity of the proposed model, setting the stage for potential future research that would use the model to predict the disposition of an entire social network over a certain period of time.

People organize themselves within complex social networks, and where they are in their social networks can have serious implications for how they view the world. Unfortunately, finding data that is useful in creating social networks is incredibly difficult. To allow us to test a model mapping the dissemination of ideas, we designed a program that can randomly generate graphs in which vertices represent people and edges represent connections between people. Associated with each person, is a set of Linear Ordinary Differential Equations representing the disposition of the person toward a certain aspect of an idea. For example, if we were modeling a presidential election, there would be a certain probability a person would lean toward the Republican, Democratic, Libertarian or Green Parties at any particular time. The goal of this research is to develop the tools necessary to analyze our simulated social networks.

The existing field of musical set theory provides numeric representations of fundamental musical elements such as pitches and pitch classes. Our research is directed at creating an algebraic model of musical harmony that is suitable for automation. We began by extending the simple numeric representations in musical set theory to group structures. We then created vector representations of more complex musical structures. Using linear operations on these vectors, we created a model that predicts the root and tonality of a chord defined by arbitrary pitches. With this information, we were able to ascribe harmonic roles to the transition between every pair of chords. We hypothesize that a model based on these harmonic roles could predict the keys of chord progressions defined by arbitrary chords. In the future, we hope these models could be extended to include iterative feedback, furthering their automation potential and accuracy.
This talk serves as an introduction to using simple combinatorial tools to study basic algebraic structures. We will look at the cyclic and dihedral groups, counting the number of elements where there are precisely $k$ elements such that $x$ is the identity of our group. We generalize what the greatest $k$ less than the size of our group will be, as well as the least $k$ greater than one.