

PROCEEDINGS

OF THE SIXTH ANNUAL UNDERGRADUATE RESEARCH SYMPOSIUM



THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

PROCEEDINGS

of the

Sixth Annual Undergraduate Research Symposium

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The University of Tennessee, Knoxville
John C. Hodges Library

The Sixth Annual Undergraduate Research Symposium is organized by the Undergraduate Research Students' Association (URSA), which was founded in 2010 and is dedicated to expanding access to research for undergraduates at the University of Tennessee, Knoxville. The Symposium provides a space for undergraduates in all disciplines to give oral presentations of their work to an audience composed of the general public, their professors, and their peers. More information about URSA can be found online at www.ursautk.org.

The Sixth Annual Undergraduate Research Symposium is sponsored in part by the Office of Undergraduate Research, the Department of Biosystems Engineering and Soil Science, the Department of Child and Family Studies, the Department of Earth and Planetary Sciences, the Department of Entomology and Plant Pathology, the Department of Materials Science and Engineering, the Department of Microbiology, the Department of Nuclear Engineering, the Department of Psychology, and the Department of Theory and Practice in Teacher Education, at the University of Tennessee, Knoxville. We especially thank the John C. Hodges Library and its staff for their gracious accommodations for this year's Symposium.

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Schedule of Events

8:00 - 8:30 AM

BREAKFAST

Please join us for coffee and breakfast pastries outside of the Lindsay Young Auditorium.

8:30 - 9:00 AM

OPENING REMARKS

Dr. Taylor Eighmy, Vice-Chancellor for Research and Engagement

9:00 - 9:55 AM

SESSION I

10:00 - 10:55 AM

SESSION II

11:00 - 11:55 AM

SESSION III

12:00 - 12:30 PM

KEYNOTE SPEAKER

Dr. Gladys Alexandre, Professor and Associate Head of the Department of BCMB

12:30 - 1:00 PM

LUNCH

Lunch will be served outside of the Lindsay Young Auditorium.

1:00 - 1:55 PM

SESSION IV

2:00 - 2:55 PM

SESSION V

3:00 - 3:55 PM

SESSION VI

4:00 - 4:15 PM

CLOSING REMARKS

Session I - A

Toxicity Testing of Cellulose Nanocrystals Using Bioluminescent Bioreporters

Kelly Arnholt

Faculty Mentor: Dr. Steven Ripp

Biochemistry and Cellular and Molecular Biology & Environmental Studies

In response to increasing concerns over the exposure of humans and wildlife to toxic chemicals in the environment, several assays have been developed to detect these chemicals. One such assay is the luxCDABE-based bioreporter *Escherichia coli* 652T7 in which bioluminescence is constitutively expressed and can be used to detect and monitor toxic effects of a material on living cells. The purpose of this study was to evaluate the toxicity of cellulose nanocrystals (CNCs) using this assay. The effects of CNCs were investigated over a range of concentrations, reaction times, and EC50 values. The results of the assay indicate that CNCs are not toxic in concentrations lower than 250 mg kg⁻¹ but in concentrations 300 mg kg⁻¹ through 10,000 mg kg⁻¹ the toxicity increases in proportion to the increase in the concentration of CNCs. The bioluminescence showed the strongest signal at 0.75 h after interaction with CNCs, with an EC50 of 1518 mg kg⁻¹ after 2 h. The impact of ultrasonic dispersion on CNCs was also examined and the results indicate that dispersion increases CNC toxicity. The results of this study suggest that CNCs would not have adverse environmental impacts at low concentrations but could become hazardous at higher levels.

Comparison of Biotic and Abiotic Measures of Water Quality in Protected and Unprotected Streams of the Tennessee River Watershed in Knoxville, Tennessee

Kimberly Bress

Faculty Mentor: Lisa Cantwell

Neuroscience

The protection of streams from direct contact with the effects of urbanization can minimize the negative impact of anthropogenic and industrial activity on stream water quality. The preservation of stream water quality is essential to maintaining the dynamic ecological role of streams within the watershed region. Abiotic indicators of water quality can affect the diversity of aquatic macroinvertebrates within a stream ecosystem, which serves as a biotic indicator of stream health. One protected stream and one unprotected stream in the Knoxville area of the Tennessee River watershed were sampled for measures of pH, turbidity, dissolved oxygen, and aquatic macroinvertebrate diversity. These measures were indicative of the quality of the water in each stream. There was no significant difference in levels of turbidity and dissolved oxygen between the two streams. The protected stream had a significantly more neutral pH and more diverse aquatic macroinvertebrate population. Direct exposure to anthropogenic sources may have resulted in the more acidic pH observed in the unprotected stream. The results of this investigation only included samples from two streams. Therefore, this exploration is considered a case study and cannot be used to make broader generalizations about the relationship between water quality and stream protection. Further investigation is required to draw a valid comparison of stream water quality between protected and unprotected urban streams.

Hadrian vs. Apollodorus of Damascus: Who Built the Pantheon?

Weston Vawter
Faculty Mentor: Dr. Stephen Collins-Elliott
Anthropology & Classical Archaeology

During the reign of Hadrian, many building projects were undertaken that have been attributed to Hadrian. He has been accredited with building a great wall which expanded the Northern frontier in Britannia, which bears his name, with the rebuilding of the Parthenon, and many various monuments and buildings throughout the empire. But there is some controversy, especially with the Parthenon, whether it was Hadrian who designed these buildings or if it was a man named Apollodorus of Damascus. Using various evidences from buildings that are known to be built by Hadrian and those known to be built by Apollodorus of Damascus, this paper will look at the styles and the means in which they were constructed to compare against those buildings whose designer is questionable. By looking at manuscripts from the time as well as looking at the opinions of others, the origins of the plans of these buildings will be discerned so that a person may be able to tell whether these questionable buildings were indeed made by Hadrian or Apollodorus of Damascus. With this information being collected, this paper will hopefully be able to utilize new perspectives to answer an age old problem.

Session I - B

Foraging Behavior of Carolina Chickadees (*Poecile carolinensis*) and Tufted Titmice (*Baeolophus bicolor*) in Response to the Body Orientation of Snake Predator Models

William Johnson
Faculty Mentor: Dr. Todd Freeberg
Honors Ecology and Evolutionary Biology

Animals must assess their surroundings for threats and respond to any perceived risks. Animals have evolved to reduce risk of predation by recognizing the threatening cues of potential predators. One such cue is the face and body orientation of the predator. However, an animal's ability to detect the head may be more difficult when the predator's body is serpentine (thus having little distinguishing factors between the head and tail.) This study explored the ability of Tufted Titmice (*Baeolophus bicolor*) and Carolina Chickadees (*Poecile carolinensis*) to distinguish the body orientation of predator snakes. We conducted behavioral observations at three locations in eastern Tennessee, each having multiple sites with a stocked bird feeder. A balanced, repeated measures design was used such that each bird flock was exposed to a snake model where the head was facing the feeder or the tail was facing the feeder during different sessions. Observers recorded the bird species, latency of the first bird to take seed, and the number of visitations by birds to the feeder during each session. The results showed that significantly fewer visitations took place when the head of the snake model faced the feeder compared to when the tail faced the feeder. This supports the notion that the birds are able to distinguish between the head and tail of a snake-like predator. Therefore head and body orientation may be an important factor that animals use to assess predation risk even when those orientation cues are hard to discriminate, such as with serpentine predators.

The Bean Interview

Chelsea Lessard
Faculty Mentor: Dr. Sarah Colby
Nutrition

In a society where health care costs are rising with high rates of obesity caused illnesses, health and nutrition are becoming an important conversation. A lack of knowledge can play a role in the practicing of unhealthy behaviors. Education about realistic and available modifications made to the diet could allow for healthier changes. Beans, for instance, are an example of a rich protein and fiber source that is often overlooked by the general public. Beans have a low glycemic index, contain no cholesterol, and have an abundant supply of essential vitamins and minerals. In addition to the nutritional benefits, beans offer environmental advantages by their versatile and inexpensive nature. In an effort to promote the benefits of beans to college students on the University of Tennessee's campus, a 15 question interview to determine the knowledge and perceptions college students have regarding beans was developed. College students from various backgrounds and disciplines aged 18 to 29 participated in the interview, 15 whom were male, and 15 whom were female. Questions such as, "how many beans can you name?" and "why do you eat beans?" were asked. The study found 13% of students could not name one varietal of bean, and 28% of students felt beans were unavailable on campus. This interview is a subset of the "Get Fruved" research study, a social marketing campaign promoting healthy behaviors in young adults. The findings in this study will help provide insight as to what college students think about beans, and to understand where interventions need to be focused.

The Effect of Encapsulated Soil Organic Matter on Herbicide Retention

Kenna Rewcastle
Faculty Mentor: Dr. Jie (Joe) Zhuang
College Scholars: Ecosystem Ecology and Biogeochemistry

Conservation tillage, an agricultural practice that minimizes disturbances to soil structure and promotes soil biodiversity, is becoming more popular on the global stage as a mechanism of decreasing erosion, nutrient and water loss, and organic decomposition. Unfortunately, agricultural practices that employ conservation tillage rely on chemical herbicides to reduce the presence of weeds on cropland. These herbicides could quickly transported through a network of soil pores resulting in contamination of groundwater reservoirs and surface water systems.

The accumulation of soil organic matter (SOM), which is an established effect of conservation tillage practices (Six et al., 1999; Balesdant et al., 2000), has the potential to alter the fate and transport of inorganic agrochemicals through two important processes: modifying the surface chemistry of soil particles to affect agrochemical retention, and changing the structure of soil pore networks to affect movement.

Using a column transport experiment, we demonstrate the effect of increased SOM present in no-till agricultural fields in retaining the herbicide Alachlor. As such, the implications of this research stem far beyond preventing environmental contamination and lowering agricultural costs. This mechanism for improving herbicide efficiencies is a large step towards agricultural sustainability, and has widespread effects in many different industries.

Forest or Phylogeny?: Untangling Phylogenetic Signal from Selection Pressure Using *Barronopsis texana*

Imani Chatman

Faculty Mentors: Jenn Bosco & Dr. Susan Riechert
Ecology and Evolutionary Biology

Behavioral trait correlations in *Agelenopsis* spiders have been shown to be both phenotypically and genetically linked. This manifestation suggests an adaptive quality that confers a survival advantage in the presence of trait linkages. If trait correlations persisted in the absence of directing selection pressures, the correlations could prove to be maladaptive. Although many studies have proven the existence of said linkages, few have considered the possibility of broken correlations across members of the same species that live in different environments. This study examines the role of phylogenetic signaling in conjunction with that of environmental selection pressures. We tested boldness, aggression, and general activity levels of local *Agelenopsis aperta*, local *Barronopsis texana*, and desert *Agelenopsis aperta* to determine whether trait correlations existed between members of the same species or species living in similar environmental conditions. Using Dr. Susan Riechert's established ethological tests, I conducted behavior trials on 69 penultimate *Barronopsis texana* individuals to compare their behavior profiles to those of the *Agelenopsis* spiders. After compiling the profiles, we discovered that the local *Agelenopsis* spiders behaved more similarly to their sister species, *Barronopsis*, than their conspecifics from the desert. These results are a small part of the first study that will provide concrete empirical evidence to support the idea that environmental selection pressures, not phylogenetic relationships, control for the manifestation of behavioral trait correlations in *Agelenopsis* spiders.

Session I - C

The Synergy of Disney Animated Films and Attractions: An Applied Film Analysis

Tyrel Prentiss

Faculty Mentor: Dr. Charles Maland
College Scholars: Film Studies

Though the word "Disney" now refers to a world-wide multi-media empire, it all began with animation. As Walt Disney himself used to say, "I only hope that we never lose sight of one thing – that it was all started by a mouse." After creating the first animated feature, "Snow White and the Seven Dwarfs," Walt wanted a new challenge. He envisioned creating a new type of amusement park where, "the parents and the children could have fun together." That vision was realized in 1955 with the opening of his first theme park, Disneyland. This "magical place" would encourage imagination, inspire creativity, and build knowledge. This paper will explore the synergy between select Disney animated movies and the attractions they inspire utilizing an applied film analysis. The greatest example of that synergy is the Disney term, "Imagineer." This is a term created and used by Disney to refer to the team of professionals who create the park attractions. From its inception, the attractions at Disneyland were based upon Disney films. Walt believed that the elements crucial to the success of his movies would translate into magical attraction experiences for Guests, Disney's term for those who visit its parks. He was right. This paper will examine rides at the original theme park, Disneyland in California, and at the most visited, the

Magic Kingdom at Walt Disney World in Florida. It will analyze the storytelling style of a select number of the original attractions created by Mr. Disney, based upon his classic animated features, and a few of the newest attractions created by Mr. Lasseter, including those based upon his Pixar films. Specifically, it will analyze, Snow White's Scary Adventure, Peter Pan's Flight, and Mr. Toad's Wild Ride, from the Disney era, and Finding Nemo Submarine Voyage, Under the Sea: Journey of the Little Mermaid, and Seven Dwarves Mine Train, under Lasseter's reign. This paper will apply a formalist analysis to the study of those attractions utilizing elements of film form and cinematic style. These will be compared and contrasted while also analyzing changing contextual factors such as aesthetics, sociocultural trends, and technology.

Engineering a Chimeric Protein Switch Through Directed Evolution

Christopher Barnes

Faculty Mentor: Dr. Eric Boder

Chemical and Biomolecular Engineering & Biochemistry and Cellular and Molecular Biology

One of the most fundamental macromolecules ubiquitous in nature is proteins. These are often activated by environmental triggers to perform their designated function, and activating and deactivating these proteins can be viewed as switching it between an "on" and an "off" state. Proteins have been engineered in a number of ways and this field has led to the creation of a number of different chimeric protein switches. This fusion of two different proteins or protein domains opens up a number of avenues for research and identifying how proteins work. One such chimeric protein is a fusion between the LFA-1 I domain and the EF3 and EF4 hands of calmodulin which are the target of this project. This chimeric protein undergoes a structural rearrangement in response to an exogenous peptide binding causing a switching behavior.

The switch used will be engineered to achieve a variety of goals. The first is that the switch will respond to a different peptide sequence and not activate in the presence of the native sequence. This means that the switch selects for the altered peptide over the native sequence to show that the switch is now specific to the altered peptide. The second goal is to characterize the mutations and to introduce further point mutations in order to see if the binding can be further enhanced. Finally, the most common mutations will be examined and introduced to see if the binding can become more specific or if tighter binding occurs.

Portable Solar Powered GPS Data Acquisition System and Contour Plotting

Spencer Early

Faculty Mentors: Dr. Daniel Costinett & Dr. Yan Xu
Computer Engineering

Elevation maps created from radar elevation data are not effective for rapidly changing landscapes such as landslide and earthquake zones. A portable system provides a solution by employing a pocket-sized GPS data logger that can be carried over the landscape to be mapped. After the data is collected, it is processed and translated into a contour map.

This project has 2 major components - the power electronics (including a boost converter to trickle charge the battery with Maximum Power Point Tracking (MPPT) and datalogging), and the software for translating latitude, longitude, and altitude data from the GPS receiver to a contour map.

Important considerations for MPPT include control strategies and hardware. A commercial power control IC would work "out of the box," but due to space constraints, the ATmega32u4 microcontroller will perform MPPT in software. Particular challenges include deciding whether to do a full current sweep to determine the MPP or to use the simpler method of open voltage, as well as determining the optimum switching frequency.

For the software side, a 3 dimensional polynomial is generated using least squares fitting. The resulting polynomial can then be plotted in a computer algebra system. Then the polynomial is plotted alongside the original data in order to determine the integrity of the contour map.

Currently, there is no capability of creating a map using the portable solar powered system. The ATmega32u4 lacks the memory and performance to generate the contour map. Possible improvements include using a single board computer such as a Raspberry Pi or BeagleBoard, but this would require more power and take up more space.

Session I - D

An Evaluation of the Precious Prints Project: The Emotional Impact of Preparing a Keepsake on NICU, PICU, and ER Nurses

Bethany Worsham
Faculty Mentor: Dr. Reba Umberger
Nursing

Emotions are a complex part of the human experience; they permeate every aspect of life—including the workplace. Nurses have a unique familiarity with emotions because they work so closely with patients and families and offer not just physical attention, but emotional care as well. Nurses who work in high-acuity locations, such as the neonatal intensive care unit (NICU), pediatric intensive care unit (PICU), and emergency room (ER) face emotions related to loss on a fairly regular basis. The impact of providing keepsakes on families is well-stated in the literature; however, little information exists on how preparing and providing a keepsake influences the nurses who prepare them. The purpose of this project was to examine experiences of nurses who prepare and provide Precious Metal Print (PMP) keepsakes for families after the loss of a child. Semi-structured face-to-face interviews with NICU, PICU, and ER nurses who have prepared a PMP were conducted using questions based on the Le Poidevin Multidimensional Model of Grief. Interviews were transcribed verbatim and content analysis was used to code each transcript according to emerging themes. We color coded text based on themes associated with the model (functioning, grief, and growth work) and others that emerged from the transcripts. Nurses shared experiences that reflected major themes from the model. They expressed comments that show how they support one another. They experience a “gamut of emotions when...deal[ing] with someone’s death” and their “worthiness as a nurse to provide something good [a Precious Metal Print] for somebody” was expressed. Providing a keepsake is a longstanding means nurses have used to support families during their time of grief. This pilot project begins to explore how providing a keepsake also supports nurses as they grieve. More work is needed in this area.

Reporting of Central Line-Associated Bloodstream Infections

Benjamin Woodward
Faculty Mentor: Dr. Reba Umberger
Nursing

Central line-associated bloodstream infections (CLABSIs) occur at an estimated rate of 4.1 - 6.1 infections per 1,000 catheter-days in medical-surgical ICUs, resulting in an absolute mortality increase of 10-30 percent for these patients. CLABSIs are infections of the blood attributed to a central line. Diagnostic criteria follow the Centers for Disease Control and Prevention guidelines for laboratory-confirmed bloodstream infections (LCBIs). LCBI 1 requires one or more positive blood cultures within a 24-hour period unrelated to an infection of any other site; and, LCBI 2 requires patient fever or hypotension with the positive blood cultures. The purpose of this presentation is to elucidate the state of the science regarding CLABSIs, with emphasis on reporting, as changes have occurred with new legislation such as mandatory reporting and the Affordable Care Act. Following an extensive search of online databases, the author reviewed eight key articles regarding CLABSI prevention and best practices. Overall, CLABSI rates have decreased in the past decade, yet focus must remain on CLABSI prevention. There is a gap in the science

pertaining to how the previously mentioned legislation has influenced CLABSI reporting rates and processes of care related to CLABSI. Future research will explore accuracy of reported incidence rates.

Kinship and Disaster Resilience in Rural Appalachia

Erin Conley
Faculty Mentor: Moriah McArthur
Nursing

Rural Appalachia encompasses a wide range of land and people in the eastern United States and is rich with history and culture. However, mountainous terrain and economic hardships create challenges for many residents in accessing resources such as healthcare, higher education, and other financial and practical assets, resulting in health disparities and lower access to care than urban areas. Low population density and distance further contribute to these challenges and impede communication, especially during emergencies and natural disasters. This region experiences frequent flooding and storms, and residents are often left with damaged homes, closed roads, power outages, and no way to access help or properly evacuate. Elderly residents in particular are at risk of being adversely impacted by disaster and are vulnerable to poor health outcomes in times of crisis. The purpose of this project is to explore how existing community strengths can be used to improve disaster resilience among elderly community members. Literature from CINAHL, PubMed, PsycINFO, EBSCO Host, and Anthropology Plus databases reveal that barriers and facilitators to accessing primary healthcare in Rural Appalachia are well documented, but little is known regarding how residents effectively cope with health and safety during disasters. The authors found that strong interpersonal relationships are already a source of social capital, bringing strength, power, and unity into the community. By focusing on kinship, communication, and decision-making, the authors conclude that further research is needed to explore how these factors can be utilized to improve health education, risk communication, and disaster preparedness for rural populations.

Session II - A

Non-degradable securin in *Caenorhabditis elegans*

Marian LaForest
Faculty Mentor: Dr. Joshua Bembenek
Biochemical and Cellular and Molecular Biology & Honors English

Cell division is an important biological process; defects in cell division can lead to cancer and infertility. Separase and securin are two proteins that are crucial to this process. Separase cleaves the “glue” that holds sister chromatids together until the onset of anaphase. It also has a role in membrane trafficking, which is essential for cortical granule exocytosis and cytokinesis. Cortical granule exocytosis is when vesicles move proteins to the membrane, which creates the eggshell to prevent polyspermy after fertilization. Separase localizes to the cortical granules and is required for exocytosis. During cytokinesis, separase localizes to the furrow and midbody to regulate vesicle trafficking events. Securin acts as an inhibitory chaperone for separase, which means that it keeps separase inactive and helps it move around the cell. Securin binds separase until the Anaphase Promoting

Complex/Cyclosome marks securin for degradation to allow chromosome segregation to occur.

The goal of this project is to examine how securin regulates separase function in cell division and cortical granule exocytosis. More specifically, to focus on how the degradation of securin regulates separase's function in cytokinesis and cortical granule exocytosis. We hypothesized that expressing a non-degradable form of securin would inhibit both chromosome segregation and vesicle trafficking functions of separase. To address this, we have created a transgenic *Caenorhabditis elegans* line expressing non-degradable securin tagged with a fluorescent molecule. This fluorescent molecule allows us to follow securin in embryos in real-time movies. These movies help ensure that securin is not degraded and show where securin-bound separase moves in the cell.

Our preliminary data suggests that in non-degradable securin lines anaphase is slower and there is embryo lethality. Non-degradable securin exhibits increased presence on chromosomes and the cell cortex and take longer to disappear. Unexpectedly, non-degradable securin's signal persists into later development. Non-degradable securin localizes the same as wild type does, though the signal intensity varies. For example, non-degradable securin has a more intense signal going into meiosis two than in wild type. In the future, we will be investigating if there are any defects in cortical granule exocytosis and if cytokinesis failure occurs.

Synthesis and Characterization of Ln[Hdpm]_x Compounds

Ashlyn Jones

Faculty Mentors: Dr. Howard Hall & Dr. John D. Auxier II
Chemistry

In order to thoroughly perform radiochemical analysis, solution phase separations are a necessary and conventional process. However, the traditional methods are often slow and tedious processes, hence the need for more rapid separation techniques. This work involves the exploitation of gas-phase chemistry for the isolation of fission and activation products in the immediate aftermath of a nuclear explosion. In this work, the synthesis and gas thermochromatographic separations of rare earth element (REEs), heavy transition metals ($Z > 72$), will be presented. The metals form complexes with 2,2,6,6-tetramethyl-3,5-heptanedione (Hdpm) at volatilized temperatures between 175-250 degrees C. The characterization of these products with Fourier Transform Infrared Spectroscopy (FT-IR), Powder X-Ray Diffraction (P-XRD), Inductively Coupled Plasma Time-of-Flight Mass Spectrometry (ICP-TOF-MS), and melting point analysis will be discussed. In this work, the experimental separations as well as determination of key thermodynamic parameters that control these systems have been explored. This method offers the advantage of rapid, carrier free separations, in addition to providing elemental and isotopic composition information regarding a given sample. Furthermore, this work also supports the growing need for rapid separation and analysis of short lived isotopes currently being used in the radiopharmaceutical and nuclear medicine community and the super heavy element discovery research efforts. The completion and results of this work represent the first in depth characterization of volatile lanthanide organometallic complexes in aqueous and gas phases. This work also highlights a novel nuclear forensics technique for use in the identification of elemental and isotopic components in a post nuclear weapon detonation scenario.

Genetic Investigation of Separase's Role in the Viability of *Caenorhabditis Elegans*

Krishen Gosine
Faculty Mentor: Dr. Joshua Bembenek
Biochemistry and Cellular and Molecular Biology

The protein separase was first associated with its role in the degradation of the protein complex cohesin, the glue that holds sister chromatids together during cell division. Defects within the gene that codes for separase can alter an organism's ability to reproduce. Some of these altered states include sterility and embryonic lethality due to failed chromosome segregation. Interestingly, in *Caenorhabditis elegans*, there is an allele of separase that still has high lethality and sterility effects even with minimal chromosome segregation failures. The objective of this study is to use genetics to shed light to how mutations affect different aspects of cell division and defects in *C. elegans*. We conducted a chemical mutagenesis screen using temperature sensitive mutant alleles of *C. elegans* separase to explore the mechanisms of other causes for embryonic death and defects. We screened the mutagenized separase F2 progeny for mutants that rescued from embryonic lethality and sterility. We are currently characterizing these mutants. Also, we have identified mutations in both separase, and protein phosphatase 5 (pph-5). Our results suggest that separase not only regulates itself, but is also regulated by other genes. We are investigating these separase mutants through genetic analysis to identify mutations within other genes that will lead to further insights of separase's role in cell division.

Session II - B

Compton Spectrometer

Blake Erickson
Faculty Mentor: Dr. Yuri Kamyshkov
Physics & Mathematics

The $\text{NO}\nu\text{A}$ experiment at Fermilab plans to explore neutrino mass hierarchy and CP-violation in neutrino oscillations. This experiment calls for large-mass detectors, on the 10 kT scale. These detectors are composed of many smaller cells, allowing measurement of neutrino energy as well as neutrino direction. Practical considerations lead to liquid scintillator as the detection material in $\text{NO}\nu\text{A}$. However, the nonlinear energy response of each cell is unknown and must be obtained experimentally. A small $\text{NO}\nu\text{A}$ detector prototype cell was studied with the UT Compton Spectrometer to measure this non-linearity. A high-resolution germanium semi-conductor detector is set a known angle and is able to pivot about the liquid scintillator at a fixed radius. Both the $\text{NO}\nu\text{A}$ cell and Ge-detector are fed into an electronic system capable of recognizing time coincidence. Once a collimated beam of gamma rays strikes the liquid scintillator and is scattered, the germanium detector selects events at a certain scattering angle, and therefore energy, to be recorded. Using relativistic equations for Compton scattering, the energy deposited in both detectors can be determined. Repeating this process at various angles allows for the mapping of the liquid scintillator's response to electrons in the 0 to 1 MeV range.

Probing the Quark Gluon Plasma - Background Subtraction Methods

Meg Stuart

Faculty Mentor: Dr. Christine Nattrass
Computer Science, Physics, & Mathematics

The theory of quantum chromodynamics predicts the existence of the quark gluon plasma at high energy density. At very high energies, the strong force binding quarks and gluons into nucleons breaks down and nucleon bounds become irrelevant. The QGP is produced by and studied at the Large Hadron Collider at CERN. To explore the medium's properties, scientists must measure how the medium alters jets traveling through it. This alteration, or suppression, can be seen through the loss of momentum and spreading of particles produced by a jet due to interactions with the nuclear matter. The problem with measuring jet suppression is the existence of a huge background of low momentum particles that are not part of the jet. This poses a problem with analysis, so I have been developing and testing a previously untested model for background subtraction and applying it to simulated data.

The Threat of Gender Nonconformity to Christian Authorities in Antiquity

Robert Cremins

Faculty Mentor: Dr. Tina Shepardson
Religious Studies & Social Work

In early Christianity, the perception of morality functioned as social capital. So, to an extent, demonstrating morality upheld power. The performance of one's gender became a way of revealing morality. Through the construction or manipulation of gender, one could exert control and influence over others ideologically. The late antique Life of Pelagia provides an excellent example of a person whose gender was manipulated in order to uphold an ideology that Christian authorities worked to construct. Through dictating the correct performance gender, male leaders, such as the earlier second-century Clement of Alexandria, constructed gender in a way that supported their own morality, and thereby power. Those who disrupted the gender ideology threatened the cosmology that helped to uphold and construct male Christian power. Therefore, some Christian leaders, such as Clement of Alexandria, John Chrysostom, Athanasius, and other powerful rhetors, constructed and upheld the demonized category of the effeminate in order to preserve and expand their power. Placing gender nonconforming men and women into categories that promoted their ideology functioned as a tool by which the power of male Christian authorities could be perpetuated. Gender nonconforming men were categorized as effeminate and holy women became men.

Session II - C

Determining Identity: The Use of the Sustentaculum Tali of the Calcaneus in Estimating Sex

Christine Bailey & Kristen A. Broehl
Faculty Mentor: Dr. Amy Z. Mundorff
Anthropology; Anthropology

Sex estimation is a crucial component when building a biological profile from skeletal remains. However, conventional methods of sex estimation are not always feasible when certain sexually dimorphic elements are not present or are fragmented. Therefore, it is important to develop additional methods for sex estimation using less conventional skeletal elements. This study aims to use the sustentaculum tali (ST) of the calcaneus for sexing unknown skeletal remains. Several studies have shown measurements of the calcaneus and talus to be useful in sex estimation. The talus, in many studies, has yielded better results than the calcaneus. Since the ST is a point of articulation between the calcaneus and talus, and since measurements of previous studies cross over the ST, we hypothesize that this portion of the calcaneus will be useful in discriminating males and females. Our study included calcanei from 40 individuals, 20 male and 20 female, from the William M. Bass Donated Skeletal Collection at the University of Tennessee, Knoxville. Measurements included maximum length, width, height, and facet length of the ST, collected by two researchers at different times to also assess interobserver error. Discriminant function analysis will be run on the measurements and tested using a separate sample of 25 individuals. We expect there to be sex differences that will aid in discriminating male from female skeletal remains.

Verbal Imagery and Blindness in *Oedipus Tyrannos*

Samuel Brakebill
Faculty Mentors: Dr. John Friend & Dr. Christopher Craig
Classics

Oedipus Rex is a play as rich in style as it is in subject matter. It is the descriptions of Oedipus' past deeds and present actions which reveal the extent of his crimes. Sophocles chose his vocabulary carefully in order to convey both the personal character of Oedipus and the depth of his unholy deeds. From the opening lines onward, Sophocles uses a combination of direct interactions between characters and the words themselves to show both the descent of Oedipus and the rectitude of the culmination of his ill-fated quest for answers.

Intimately tied to this theme of moral corruption in an otherwise excellent ruler is Sophocles' use of the word and its various forms to show both the innate taint of Oedipus and to build suspense during the performance. This word is also used by Sophocles in this context to contrast the assumptions Oedipus makes regarding his own past and his actual origins. This idea of moral taint twists the idea of Oedipus into a dark example of the founding story archetype as demonstrated by Sophocles' use of the word "εὔρημα".

Finally, Sophocles uses these verbal images to demonstrate that Oedipus deserves what happens to him. Sophocles does not argue that Oedipus is truly punishing himself for his actual crimes, but rather he is punishing himself for his failure to piece together the truth beforehand.

Alternative Medicine Access and Affordability: What the Medical Cannabis Model Has to Offer

Miranda Gottlieb
Faculty Mentor: Dr. John Scheb
Honors Political Science

To direct emerging markets of alternative medicine, a new federalized taxation policy on legalized recreational (retail) cannabis can be allocated for research and distribution of alternative therapies and guide the national transition into an alternative medicine friendly health care system. Presently, no state or federal health insurance provides reimbursement for cannabinoid products due to Schedule I drug classification. The framework of state operated medical cannabis access provides a model from which other investigative and alternative medicines can utilize. The same tax dollars that once pursued the illegal market interdiction should be allocated to a new standard in alternative medicine policy. The overarching issue remains: access to alternative medicine and treatment is restricted to only those who can afford it. The policy presented provides a suggestion for a state implemented, sliding scale, income based, payment model for access to alternative or experimental medicine. The income payment scale should extend beyond medical cannabis and apply to any investigative drug therapy. Moreover, the additional revenue freed through modifications to federal cannabis policy can be redirected to develop the necessary safe access to experimental and alternative treatment. The creation of alternative pharmacies would require a doctor recommendation similar to medical cannabis and maintain state mandated regulations. As more states seek cannabis policy changes, the most productive approach for alternative medicine is through proactive legislative and infrastructural suggestions. The purpose of the policy is not to solve the outstanding social and legal conflicts regarding cannabis use or access, but rather, offer a prospect of new dialog that could alter the stigmatization of not only cannabis, but alternative medicine as a whole.

Session II - D

Developmental Screening in Children and the Emotional Response Elicited by the Parents to the Outcome

Ashley Manus
Faculty Mentor: Deb Chyka
Nursing

Using age-appropriate developmental screening tools in young children may be the initial step in the identification of socialization, language, and/or motor skill delays when evaluations are conducted. Early detection of these delays, with subsequent early interventions, are critical to foster/promote proper growth and development. Elective evaluation is contingent upon the willingness and desire of parents to seek evidence regarding atypical screening results. Current literature does not address parental responses or emotions experienced after receiving notification that developmental concerns about their child have been identified. Trepidation may cause some parental hesitation about pursuing further evaluation for their child thereby delaying definitive diagnosis and early intervention efforts. Future research may provide evidence to guide discussions between parents and healthcare providers toward improving follow-up evaluation rates that could lead to earlier diagnosis and treatment.

The Effects of Tactile Stimulation on Neonates Experiencing Neonatal Abstinence Syndrome

Rebecca Jeannine Bell
Faculty Mentor: Deb Chyka
Nursing

Among the population of neonates experiencing neonatal abstinence syndrome there is an astounding deficit of maternal care among the majority of neonates residing in the NICU. Maternal care is critical to the physical and emotional development of any infant, and it is especially critical in the development of an infant experiencing the signs and symptoms of withdrawal. Because of this deficit, many neonates are forced to cope with withdrawal symptoms without the nurturing comfort of a maternal presence. Nurses therefore act as somewhat of a substitute maternal figure for these struggling neonates; however, they do not have the time to provide individualized care that is equivalent to that of a mother. Therefore, many neonates experiencing symptoms of withdrawal are deprived of the continual warm, comforting environment of their mother's arms that is critical to soothe their anguished temperament. A gap exists in the literature that does not address the effect of "cuddlers" on the temperament and development of neonates experiencing NAS. The time spent with cuddlers provides the neonate with one on one quiet time outside of their NICU bed that may be calming both physically and emotionally. This research will address the gap by designating cuddlers for a portion of the neonates experiencing NAS, and evaluating their response to the time spent with the cuddlers. Evaluation of the neonates will include assessing their temperaments, their physical responses such as temperature, heart rate, and blood pressure, and factors such as their quality of sleep, feeding, and length of stay in contrast to those without cuddlers. Results from this project may provide evidence that supports the criticality of touch, as well as a calming and quiet environment for neonates in order to meet typical developmental milestones.

Patient Perception of Assimilation in Bilingual Discharge Facilitation

Merrell Pressley
Faculty Mentor: Karen Lasater
Nursing

Growth of the Hispanic population in the United States has contributed to an increase of limited English proficiency speakers, which presents a need for better communication strategies. Language barriers especially hinder effective communication in healthcare settings. Providing culturally competent care to Spanish speakers in order to promote their assimilation into the United States healthcare system and ensure evidenced based practice presents a challenge to many health care providers. Research shows that these language barriers may alter the accuracy of care and patient comprehension, which can lead to poor healthcare outcomes. Because they may lack accessibility to health care services, Hispanic patients often use the emergency department for primary care. Many Spanish-speaking patients leave the emergency department misinformed with a limited understanding of the medical diagnosis or the necessary treatment to prevent adverse outcomes. Though there is not a set standard of care regarding interpretation mechanisms, many hospitals have provided interpreters and language interpretation tools, such as phone lines or bilingual teaching pamphlets. However, it is unclear whether these tools are perceived by patients as effective with regard to their comprehension of discharge

instructions. Research is needed to evaluate the Spanish-speaking patient's perception of the bilingual discharge process in this patient population in the emergency department setting. A study will be undertaken to assess the patient's experience of bilingual discharge facilitation or the lack thereof. This phenomenological study will explore the Spanish-speaking patient's comprehension of and experience with emergency department discharge instructions through audio-recorded interviews in the patient's primary language.

Session III - A

Swallow Imagery in the Spring Fresco

Chloe Lovelace

Faculty Mentor: Dr. Aleydis Van de Moortel
Honors Classical Civilization & Political Science

The Spring Fresco, or the fresco of the Room of the Lilies, from the Delta Complex at the Late Bronze Age Aegean site of Akrotiri is considered to be the first painting of a nature scene in European art history. With this has come significant analysis of the fresco, which covers three walls of the small room. There has been much discussion regarding the room's purpose and the iconographic meaning of the images in the fresco, especially in regards to the flying swallows. Initially thought to be birds in courtship, the birds are now thought to be engaging in behavior that is much more substantive. Present scholarly opinion is divided about whether they display parental or combative behavior. However, neither of these explanations fully accounts for all the bird behavior depicted in this room or for the birds' relationship to the other components of the painting: the lilies and the multi-colored rocks. Moreover, neither interpretation accords well with the purported cultic function of the room. This paper seeks to offer an alternative explanation of the swallows and the lilies as representations of the cycle of life. This interpretation accounts for all of the swallow and lily images in the room and it fits its cultic context much better, thus providing a deeper and more holistic understanding of the entire assemblage.

Gendered Patterns of Economic Marginalization and Women's Political Participation in Latin America

Alina Clay

Faculty Mentor: Dr. Jana Morgan
College Scholars

Although women in Latin America have recently made impressive advancements in political representation by achieving high-ranking political positions, embedded economic inequalities persist and significantly hinder their political participation in activities such as voting and actively supporting political parties. Furthermore, widespread policy mechanisms are not set up and effective in fully engaging women in politics. Political and economic oppression of women in this region have historical roots and thus are deeply entrenched within society. My research question explores how gendered patterns of economic marginalization affect the political participation and attitudes of women in Latin America. To answer this question, we have analyzed cross-national data on gender inequality in incomes, based on compiled household income surveys in Latin America. We have also analyzed indicators of Between-Sex Inequality (BSI) that illustrate the extent

to which income has disproportionately advantaged men over women in Latin America and how these income patterns have evolved over time between men and women. The data suggest that gender inequality across Latin America has gradually decreased over the past three decades and that overtime variation within countries is larger than cross-national variation. Additionally, we have found that gendered patterns of economic marginalization significantly diminish women's political participation, which contributes to their political and social marginalization.

Neither Here Nor There: Borrowed Bodies, Third Space, and the Museum

Rebecca DiGiovanna
Faculty Mentor: Dr. Mary Campbell
College Scholars: Museum Studies

The contemporary art world is in a state of great flux and change. In part due to globalization, present-day artists are producing works that no longer adhere to dichotomies of male or female, black or white, and Asian or American. Instead, artists are merging these seemingly separate identities into new forms of categorization and selfhood.

Using expatriate artist Zhang Huan's *My America* (2000) as a vehicle for discussion, my work examines post-colonial Chinese philosopher Homi Bhabha's *Third Space of Enunciation* (2004) and its relationship to the rising multiplicity of identity seen in contemporary artists. Bhabha's *Third Space* is the idea of a metaphysical space for the relationships that exist between cultures, specifically related to neglected and marginalized groups and individuals. The concept of *Third Space* provides a different kind of thinking about meaning and the significance of geography and culture. It encourages thinkers to set aside demands to make an either/or choice and contemplate the possibility of a both/and also logic.

Through a close analysis of Zhang's *My America* and Bhabha's theory of *Third Space*, I explore the impact of traditional binary constructs in cultural institutions like the museum. I make the argument that binary rationality results in polarizations, such as Eastern versus Western culture. Culture is essentialized and borders separating cultures are reinforced. If these binary notions are deconstructed, it is possible to strengthen intercultural communication and awareness and reduce the potential for conflict.

Using the museum as a metaphor for *Third Space*, I explore the need to transform and reinvent the way modern museums deal with cultural ancestry, geography, and the shifting and malleable nature of modern identity.

Session III - B

Of Wood and Fire: Evidence for the Role of Asherah in Israelite Religion

Taylor Thomas
Faculty Mentor: Dr. Erin Darby
Religious Studies & Anthropology

In the early days of Israelite religion, cultic practices and icon worship were common. One example of such practice involves the term 'asherah'. In the Ancient Near East, 'asherah' referred to a sacred object crafted from wood that was located near places of religious gathering. It is also possible that the term 'asherah' is a reference to the ancient goddess Astarte worshipped by Ugaritic cultures. A third possibility, evidenced by the tendency of cultures of the ancient Near East to have little to no separation between deities and their physical representations and the non-static nature of religion, is that the 'asherim' existed originally as a means to invoke the goddess Asherah, facilitating her role in ancient society. Over time, the line between deity and cultic object would have become more defined, simultaneously creating literary confusion for ancient sources such as the Deuteronomist. Whether an entity or an object, 'asherah' was eventually purged from Israelite society. Evidence of attempts to do so lie in the reforms of King Josiah laid out in the second book of Kings. This presentation will explore the possibilities of the nature of 'asherim' through the analysis of ancient texts and the language within used to describe the 'asherim' and their function in Israelite society. It will synthesize the arguments for common perception of asherah and describe the role of the deity and/or relic in non-Israelite cultures of the Ancient Near East. Beyond literary description and analysis, this presentation will focus on material culture remains to describe the actual presence of 'asherim' in Ancient Israelite cultural practice, drawing on data gathered from the excavations of Kuntillet 'ajrud' and Khirbet el-Qom.

Adaptation and Robustness in a Chemotaxis Network

Beini Chen
Faculty Mentor: Dr. Steve Abel
Chemical Engineering & Mathematics

Adaptation is a behavior of biological systems in which a sustained change in input signal leads to a transient output response that returns to the pre-stimulated output level. Cells use adaptation to maintain sensitivity to the changes in their environment and to remain in homeostasis while the input signal is perturbed. Signaling networks in both prokaryotic and eukaryotic cells demonstrate adaptation, which is a common feature of chemotaxis, a signal transduction process that enables cells to sense chemical gradients in their extracellular environment and to adjust their movement in response. In the case of *Escherichia coli*, the bacteria swim in random directions in the absence of a chemical gradient, but will move toward or away from the chemical when a gradient exists. In this study, we use computational methods to study adaptation in the chemotaxis network of *Escherichia coli*. Based on the well-characterized two-state model of Barkai and Leibler (Nature 1997), we numerically analyze the chemotactic network with ordinary differential equations and measure the adaptation time and precision of the response to a change in ligand concentration. The adaptation time is the time that the signal takes to reach steady-state after a perturbation in input, and precision measures the difference between output and input levels. We find that the network exhibits a sensitive response and precise adaptation to the input stimulus. We also analyze the robustness of the network by randomly

varying the kinetic parameters and characterizing the change in behavior. The adaptation demonstrates robustness: although the adaptation time varies over a wide range, the precision is nearly perfect regardless of the values of the parameters. This shows that adaptation in this network depends more strongly on the topology of the network than on the values of kinetic parameters.

Prototype Magnetic Shield Compensating Earth's Magnetic Field Down to 1nT

Alex Corlew & Zac Markland
Faculty Mentor: Dr. Yuri Kamyshkov
Physics; Physics

Some sensitive experiments require magnetic fields below the nT level. The challenge becomes clear when the Earth's 50,000 nT magnetic field is taken into account. Our prototype aims to compensate for the Earth's magnetic field and reduce the field inside the volume to approximately 1nT. To accomplish this challenge we have designed a cylinder comprised of three layers, and by using in the first layer active magnetic current supplied coils we will manipulate the magnetic field inside the volume. There are two active compensating coils and two Mu-metal (Magnetic Shield Corporation) passive shields. The active compensating coils consist of a solenoid along the Z-axis and a set of Helmholtz coils with cosine phi distribution to compensate magnetic field on the X-Y plane. In theory these two coils plus rotations should cancel out the majority of Earth's magnetic field within the experimental volume. This field will be further reduced by two annealed passive shielding. The prototype is being studied for the possible experiment with ultra-cold neutrons at LANL (Los Alamos National Laboratory).

Japanese Monkey (*Macaca fuscata*) Hand Preference in Response to Stress

Adam Partin*, Peyton Stewart, & Sami Bhidya*
Faculty Mentor: Gordon M. Burghardt
Ecology and Evolutionary Biology; Microbiology; Accounting & Biology

In investigations of hand use preference in monkeys, few studies have assessed preferences of animals reaching for food associated with a stress-inducing stimulus. In this study we analyzed video-recorded hand use by monkeys to reach for a piece of preferred food using a modified Wisconsin General Test Apparatus (WGTA) tested at Kyoto University. Eight adult Japanese monkeys, *Macaca fuscata*, raised in captivity and never having seen a snake or turtle, were trained to take a preferred food item from in front of two empty small glass aquaria. They then were given trials where one aquaria contain an animal and the other control items such as a roll of black tape with a food item in front of both. It was hypothesized that animals, especially snakes, would be stressful stimuli and affect the flexibility/rigidity of hand use in reaching for the food. The snakes used in this experiment consisted of *Elaphe climacophora* (native harmless snake), *Dinodon rufozonatum* (nonnative but large and active snake), and a venomous native *Gloydius blomhoffii*. A six trial baseline with empty aquaria began the day of testing, followed by a series of tests, and finally a post-trial baseline. The containers were on a sliding tray, which was presented to the monkey after a partition was raised. Each trial was analyzed for which hand the monkey used to grab the food. Our results show that there was a change in hand

preference over the period of testing for most of the monkeys but individual differences were also found.

Session III - C

The Role of Social Values in the Production of Scientific Knowledge

Kristen Beard
Faculty Mentor: Dr. Nora Berenstain
Philosophy

Philosophical and sociological discussions about science have established a dichotomy between the rational and social aspects of the scientific production of knowledge. Conversation amongst philosophers of science suggests that the rational and the social side of scientific inquiry are not compatible and cannot contribute to one another. However, Helen Longino offers an account of the scientific method that is imbued with influence from social context, and at the same time contributes to the rational products of the scientific method. My contribution is to offer a graphical process model to demonstrate how social context influences the scientific method and at what points in the process of scientific research do social values begin to influence its results. The explanation for this model comes in three parts. Part I defends a particular account of the method of scientific research. Part II argues that this method requires the researcher to incorporate subjective assumptions in order to have the data support a specific theory. Part II also argues that these assumptions change depending on interaction with the scientific community, moderated by the community's standards for that interaction. Part III explains how the values, interests, and assumptions of society influence the researcher's assumptions discussed in Part II, and thereby influence the results of the research. Finally, Part III also discusses the implications for knowledge produced through this socialized scientific process.

Two Sides of the Same Street: Where You Are Born, Where You Go, and How Much Say You Really Have In the Matter

Shivani Goyal
Faculty Mentor: Dr. Robert Kronick
Psychology & Spanish

This study uses quantitative and qualitative analysis to measure the impact of one's surroundings on life outcomes. It is centered on two local neighborhoods, Pond Gap and Sequoyah Hills, that are very close in proximity (approximately 3 miles apart) but one is upper-class, while the other is working-class. The analysis includes comparing the following: resident demographics (age, race, level of education, and occupation); income and wealth; family structure; school socioeconomic status (percentage of free-and-reduced lunch); test scores; crime rates; housing (renting versus owning); transportation (own transportation versus relying on public transportation); access to healthy food; and health services (accessibility and affordability). The methodology includes surveys of 20 residents and face-to-face interviews with 5 residents from each neighborhood. The interview contains open-ended questions regarding their personal background (the environment in which they grew up, access to resources and opportunities, and how they have come to where they are today), and their perception of their respective neighborhood.

The participants have been selected using convenience sampling through the elementary school and residential association in the neighborhoods. I hypothesize that those currently residing in the low-income neighborhood also come from a low-income background from birth and that those currently residing in the high-income neighborhood have come from a high-income background from birth. I further hypothesize that the participants' home and neighborhood environments at birth and throughout their development will be positively correlated with the resources and opportunities that have been available to the participants. The current neighborhood environment of the participants will be examined both qualitatively and quantitatively to examine how these factors affect the lives of both the participants and the children of the participants. This will help determine the implications present for generational poverty or wealth as well as the opportunity gap. The study is currently in progress and therefore, there are presently no conclusions to report. Due to the small number of participants, this study is not completely representative of the population of the two neighborhoods. However, it will help in identifying factors to include in a future study that conducts a larger comparative analysis involving a larger neighborhood sample.

Gendered Power Relations in Ancient Israel

Aimee Rovane
Faculty Mentor: Dr. J. P. Dessel
Psychology

Carol Meyers (2013) states, "It is impossible to recover the history of Jewish Women from the written sources except as the male writers have viewed the females in their society." From historical and biblical sources, we know that women's roles were limited to the home and that they lived in a patriarchal society. Recently, a growing body of archeological and ethnographic evidence has shown that there is more to be learned and reconsidered about Ancient Israelite women. This research is a case study of women in Ancient Israel, from a feminist perspective. It will seek the answers to questions, which get at what exactly it meant to be woman during the biblical era. Most importantly, it will seek to answer: what were the power relations among men and women? Scholars have been debating feminist issues within biblical time for decades. In the study of Jewish history, a feminist nuanced lens has been used to critically analyze the role of women in ancient times. Carol Meyers continues to be one of the most productive feminist Jewish historians. Some of her most groundbreaking contributions have been to debate whether or not Ancient Israel was really a patriarchal society. This research will examine primary sources such as the Hebrew Bible, as well as other Near Eastern documents. Primary sources will be analyzed to understand the way that biblical and historical authors viewed women. Archeological material will also be assessed. In addition, the viewpoints of Jewish history scholars will be considered and synthesized. This research will show that women played a more substantial role in Ancient Israel than was originally believed. Uncovering their significance is a task, because male topics and positions dominate scholarship of Jewish History. This research explores the gendered power relations among women in Ancient Israel and how it affected their roles in society.

Session III - D

Parental HPV Vaccine Acceptability Factors in Southern Appalachia

Lauren Speck
Faculty Mentor: Dr. Sadie Hutson
Nursing

Southern Appalachia is plagued with an increased incidence and mortality rate of cervical cancer; human papillomavirus (HPV) is the leading cause. Previous research has uncovered several factors that affect HPV vaccine uptake such as, knowledge of the disease and vaccine, susceptibility to and severity of the virus, and vaccine barriers/benefits. However, a gap exists in the literature pertaining to the role of both parents in the decision to have their children vaccinated. Specifically, dyad interviewing techniques have not been pursued among the culturally-unique Appalachian population. The purpose of this study is to assess mother-father dyads' awareness, knowledge, attitudes and opinions related to HPV and the vaccine for male children. Subjects for this study were recruited by convenience sampling. Following IRB approval, the investigator used mixed-methods data collection techniques via surveys and dyad face-to-face, semi-structure interviews. Emergent themes include: fathers' lack of knowledge of HPV and the HPV vaccine, lack of parental communication about the vaccine, a maternally- dominant model of health-care decision-making and vaccine acceptance, and skepticism regarding vaccine safety and side effects. Findings from this study will lay the groundwork for future studies as well as education and interventions targeted at the needs of parents to increase vaccine uptake.

HIV-related Stigma Among Women in Appalachian Tennessee and Alabama

Caroline Darlington
Faculty Mentor: Dr. Sadie Hutson
Nursing

Southern Appalachia holds the highest incidence rate of HIV/AIDS in the United States (US). Societal stigmatization of HIV/AIDS due to assumptions about transmission and associated lifestyle plays a substantial role in the psychosocial well-being of people living with this chronic illness, particularly women in religiously and politically conservative areas. While HIV/AIDS is most commonly transmitted among Southern women through heterosexual contact and IV drug use, sources of stigma among women include misconceptions about HIV among healthcare professionals and the conservative cultural values regarding promiscuity and same-sex transmission typically associated with HIV infection. Clinically significant effects of stigma include lack of medication adherence, depression, self-isolation, and decreased self-worth. Spiritual coping and visual media have been effective in reducing experienced and internalized stigma among HIV-positive women. However, due to the cultural specificity of stigma, research on the HIV-related stigma unique to women in Southern Appalachian counties is a significant gap in the science. The purpose of the proposed study is to comprehensively describe specific sources and internalized effects of stigma among HIV-positive women in Appalachian Tennessee and Alabama. Findings from this study have the potential to lay the foundation for tailored stigma-reduction and psychosocial interventions for this unique aggregate.

Physical Health Experiences of a Male Caregiver of a Significant Other with Breast Cancer

Meredith Haynes
Faculty Mentor: Dr. Sadie Hutson
Nursing

Breast cancer is the most common cancer diagnosis among women; the majority of women who bear this diagnosis are married. Male spouses of women with breast cancer are affected by the diagnosis in numerous ways including: intimacy and communication, emotional responsiveness, and sexual satisfaction. The purpose of this presentation is to elucidate the current state of the science regarding the effects of a breast cancer diagnosis on the male partner. The majority of published studies focus on psychosocial effects experienced by male spouses such as depression, mood changes, anxiety, tiredness, and psychological distress. In many cases, these effects have been associated with a decreased quality of life. Physical health effects of the male caregiver are largely unknown, leaving a gap in the science. Understanding the overall physical health of the male partner during diagnosis and treatment of breast cancer is critical to address the partners' needs, particularly in light of their caregiving responsibilities during this difficult time. Findings from this study have the potential to lay the foundation for healthcare providers, including oncology nurses, to develop interventions and preventive strategies to tailor clinical care and psychosocial support to male spouses of women with breast cancer.

Session IV - A

Effects of Heat Treatment, Chemical Composition, and Cladding on the High Temperature Hydrogen Attack Resistance of C-½ Mo Steels

Will Hoskins
Faculty Mentor: Dr. Carl Lundin
Materials Science and Engineering

Carbon and low-alloy steels are susceptible to High Temperature Hydrogen Attack (HTHA) in petroleum refinery vessels when exposed to high pressure hydrogen (>1 MPa) at elevated temperatures (>230°C). HTHA is a type of hydrogen damage in which hydrogen from service reacts with carbon/carbides in steel to form methane bubbles. The methane forms primarily along grain boundaries and concomitantly develops substantial internal methane pressure. The methane bubble formation, bubble accumulation and coalescence results in fissuring and loss of strength and toughness, leading to untimely failure of the component or vessel. Metallurgical evaluation and high temperature, high pressure hydrogen exposure studies were conducted on three ex-service C-1/2 Mo steel specimens (MPC-3, MPC-13, MPC-17) provided by the Materials Properties Council to investigate the effect of heat treatments, chemical composition, and stainless steel cladding on resistance to HTHA. The effects of heat treatments (normalized and tempered vs. annealed and tempered) and chemical composition on resistance to HTHA were investigated on MPC-3 and MPC-13. The box samples were fabricated to simulate the actual service conditions in which hydrogen was exposed from one side creating a hydrogen concentration gradient at a temperature of 482°C and hydrogen pressure of 6.8 MPa. The effect of stainless cladding (AISI 405) and clad thickness (0.25 mm-0.50 mm) on a normalized and tempered MPC-17 was also studied. A finer distribution of carbides in MPC-3 and MPC-13 in the normalized and tempered condition exhibited enhanced resistance to

HTHA compared to the globular and lamellar carbides present in the annealed and tempered condition. MPC-13, with higher molybdenum-to-carbon ratio than MPC-3 (3.80 vs. 2.29) showed greater resistance to hydrogen attack due to the formation of a greater fraction of more stable $M_{23}C_6$ and Mo_2C carbides compared to Fe_3C types. A 0.25 mm thick AISI 405 stainless steel clad on C-1/2 Mo base metal provided excellent resistance to HTHA compared to the unclad side in MPC-17.

Equations of State for Neutron Stars

James Vacanti
Faculty Mentor: Dr. Jirina Stone
Physics & Mathematics

Models of neutron stars are created from Equations of State. Computationally, these are given as tables. However, due to the differences in types of matter which exist at different parts of the star, multiple equations of state are needed. These must be stitched together in order to create a table which is as mathematically smooth as possible. This is done using a variety of methods. Finding the spots where these transitions are made has implications for the resulting star. Depending on the spot in the star where the transition happens, the modeled star may or may not be physically feasible.

Simple Learning in Gartersnakes

Benjamin Repsher
Faculty Mentor: Dr. Gordon Burghardt
Biochemistry and Cellular and Molecular Biology

Learning in snakes is rarely studied as compared to other reptiles such as lizards and turtles. We worked with 11 long-term captive gartersnakes, *Thamnophis sirtalis*, on their ability to learn to approach an opaque bowl containing an earthworm preparatory to studying social learning. Chemosensory cues are the major means that these snakes use to identify food. The goal was to see if the snakes could be trained to eat from a designated bowl each time and ignore the other bowl not containing a worm with its associated chemical cues. Each snake was tested twice a week on the same days. The snakes were only fed on the days tested if they successfully attacked the night crawler in the apparatus. The earthworms were placed into a bowl and placed on either the left or right of an apparatus. The other side was an empty bowl and the order was switched to prevent association by location. In the initial stages of the trial, the snakes would take anywhere from 5-20 minutes to locate the worm, but in the last series of trials the average time was greatly reduced, showing that the snakes not only learned the task but could retain memories over the long-term.

Session IV - B

Assessing Ecological Impact of Clay Flocculation Techniques by Measuring Microbial Community Structure

Kathryn McBride
Faculty Mentor: Dr. Terry Hazen
Biological Sciences

Clay flocculation is a recently developed technique that restores water systems experiencing harmful algal blooms; but the ecological impact of flocculation on the quality of these water systems has not been thoroughly studied. This project aims to assess the ecological impact of different flocculation treatments by measuring microbial community structure. In order to do this, sedimentary columns treated with three different types of flocculation were tested to observe microbial community composition. For this, one of the methods used was 16s RNA sequencing, which gave a general profile of microbial diversity; the other method was Phospholipid Fatty Acid (PLFA) analysis, which measures biomass in relation to the community structure. The results of the 16s RNA sequencing showed no significant variation in microbial composition between the different flocculation treatments and control. Preliminary PLFA results suggest small changes in the biomass between different techniques. Results of this project entail that flocculation may still have an impact on microbial community structure, which could lead to alteration of nutrient levels in sediment and affect overall water quality. This study can help broaden our understanding of potential ecological impact of clay flocculation on water and in sedimentary environments.

Prompting Awareness, Advocacy, and Policy Change through Environmental Disasters and Education

Julianna Burchett
Faculty Mentor: Dr. John Nolt
Environmental Science & Chemistry

Major environmental disasters impact individuals in a very direct and personal manner. They pose a direct threat to the individual's lifestyles, and in extreme cases, their lives. When individuals are threatened by such a disaster, it encourages a dramatic increase in public awareness, involvement, and advocacy. Two major environmental disasters are discussed and analyzed in this presentation: the Love Canal disaster in Niagara Falls and the Exxon Valdez oil spill in Prince William Sound. In each of these cases, a large number of people's lives were put at risk, prompting individuals to act in different ways to ensure that this type of problem would not happen again. The main issue that this project evaluates is that many people must experience a very dangerous environmental disaster that affects them personally in order to make them aware of the impacts that the environment can have. People prioritize items that they feel pose a direct threat to them and place the burden of other things, such as the health of the environment, onto other people. It also helps explain why people choose to ignore environmental problems until they begin to affect them personally. Both of the environmental disasters listed above were the product of some human factor. If society is better educated about the environment and how people use our natural resources, then there will be better advocacy to improve how we use resources. Current methods of educating the public about environmental issues are not the most effective at prompting awareness in people. This raises the question, is it possible by methods of education to generate the amount of concern and advocacy about the

environment that is needed to change policy in the interest of the environment? Creating a more effective environmental education program will result in a more educated and prepared society for future environmental disasters and potentially, ways in which they can be prevented.

Plasticity in a Changing World: A Comparison of Phenotypic Variability in *Boechera stricta* across Spatial and Temporal Scales

Caroline Daws

Faculty Mentors: Dr. Jill Anderson & Dr. Jen Schweitzer
Ecology and Evolutionary Biology

While some plants are mobile and able to physically distribute to more suitable environments, other plants have limited dispersal ability and must find alternate ways to adjust to changing conditions in situ through adaptation or plasticity. Predicted changes in abiotic pressures, including drought stress and warmer temperatures, may influence the phenotypic expression of traits in plant populations through these mechanisms. While populations may locally adapt in the mid- to long-term, plasticity in functional traits has been shown to mitigate the immediate and stochastic effects of climatic change. In this study, we used a reciprocal transplant approach to investigate the temporal and spatial patterns of plasticity in a native perennial mustard, *Boechera stricta*, in the Rocky Mountains. Specifically, we explore how a temporal gradient that reflects drought stress over three growing seasons affects plasticity in a suite of functional traits. Additionally, we investigate plasticity between genotypes of *B. stricta* over micro- and macro-environmental scales. To understand the influences of genotype and the environment on functional trait expression, we reciprocally transplanted 24 genotypes of *B. stricta* from across its native range into two experimental gardens. By tracking foliar and phenological traits for these plants over three years, we have been able to explore how genotype and environment interact with drought stress to induce plasticity in phenotypes. We found that the range of plasticity within and between sites was equivalent, suggesting that *B. stricta* can respond to environment at small spatial scales. Additionally, we observed patterns of plasticity consistent with drought stress such that plants exhibited enhanced water use efficiency in dry years. We demonstrate that plasticity occurs at small spatial and temporal scales, indicating potential for persistence in environments that experience unpredictable climate from year to year. The advent of drought and novel temperature regimes, as predicted by climate change, will increase selective pressures on plants, and our results suggest that plasticity may allow plants and other organisms to phenotypically keep pace with climate change by enhancing immediate survival.

Session IV - C

Development of a Radioisotope Identification Algorithm for Gamma Spectra with a Low Energy Signal-to-Noise Ratio

James Ghawaly
Faculty Mentor: Dr. Howard Hall
Honors Nuclear Engineering

Radioisotope identification algorithms (RIID) are highly important to the nuclear industry, particularly in the area of detection, for forensics, broad area detection, and sealed container evaluation. These algorithms provide a method to identify radioisotopes by reducing manual analysis of spectral data. Conventional RIID algorithms for gamma spectra generally come as part of gamma-ray detector software packages (e.g. Maestro, Genie 2K, etc) that are expensive, limited operation functionality, and are very reliant on the preset libraries. Further, conventional algorithms are often useful for detecting radioisotopes behind shielding or in various media, however; they are not very effective at identifying radioisotopes at large standoff distances where the signal-to-noise ratio is small. This research aims to create a RIID algorithm with the capability of identifying radioisotopes in gamma-ray spectra wherein the radioisotope's characteristic gamma-energy peak in the spectrum is comparable to the background noise. To accomplish this task, custom data smoothing and filtering algorithms were designed and compiled into a completely cross-platform program with an easy-to-use user interface. The algorithm incorporates a database of numerous radioisotopes, with focus being on isotopes of importance to the nuclear security industry. The database was also designed to be easy for the user to customize to the field of interest. The effectiveness of the algorithm was verified with both simulated and real source data. Overall, this algorithm has proved to be very useful for identifying radioisotopes in spectra with a low signal-to-noise ratio, which is a problem often encountered in the standoff distance in the nuclear field. **ACKNOWLEDGEMENT:** This work is being supported by the Defense Threat Reduction Agency under contract # HDTRA1-14-C-0038. This support does not constitute an expressed or implied endorsement on the part of the U.S. Government.

Voices from the Sand: Graffiti and Identity of the Roman Army in the Near East

Emma Pugmire
Faculty Mentor: Dr. Stephen Collins-Elliott
Classics

The ancient Romans controlled a vast Empire extending from the British Isles to Arabia. To maintain their Empire, the Romans created a large army. As the Empire expanded, many soldiers who joined the army were not ethnically Roman. There is a question of to what extent these provincial soldiers identified themselves as Roman and how they constructed their cultural identity, the question of Romanization. One way to come close to ascertaining soldiers' identities is through examining their writing, particularly their graffiti.

This paper will examine the graffiti found in the bathhouse at 'Ayn Gharandal, a 4th century Roman military fort in southern Jordan. These graffiti shed light on the experiences of the Nabatean *limitanei*, or frontier soldiers, who were incorporated into the Roman army. Their graffiti provide expressive writings and drawings which help us better understand how these soldiers culturally identified themselves and to what extent

they adopted Roman behavior and customs. The language choice of the texts and drawings provide insights on how the limitanei expressed their identities. The graffiti at 'Ayn Gharandal will then be compared to the military graffiti found at Dura-Europos, a larger and more published site on the Euphrates River from the 2nd century. This comparison sheds light on the similar experiences of local soldiers who were absorbed into the Roman army, as well as the differences, to create a picture of the Romanization of auxiliary soldiers in the Near East. Even though these men served in the Roman army, participated in the Roman world system, and adopted Roman behaviors, they still sought to express their native identities alongside their new one.

Teacher Student Relationship Quality as a Predictor of Loneliness in Children

Laura Beard & Rachel Welsh

Faculty Mentor: Dr. L. Chris Elledge

Psychology, Sociology & Multidisciplinary Studies; Psychology

The association between teacher-student relationship quality (TSRQ) and children's social adjustment is understudied. There is evidence that peer acceptance is partially influenced by the degree to which classmates are perceived as having positive or negative relationships with the teacher (Hughes et al., 2001). An emerging body of literature suggests that a high quality teacher-student relationship may buffer children from the impact of a negative social reputation on their risk for peer victimization (Elledge et al., under review; Troop-Gordon & Kuntz, 2013). The present study examined the concurrent and longitudinal relation between TSRQ and loneliness. Participants were 331 2nd - 4th grade children (51.8% male; 67% Caucasian). TSRQ was assessed via peer-nomination items. Loneliness was assessed through self- and peer-report. TSRQ was negatively associated with self- ($b = -.24, p < .05$) and peer-reported ($b = -.30, p < .05$) loneliness. However, TSRQ did not predict changes in self- or peer-reported loneliness overtime. Findings suggest children with low quality relationships with their teachers are often lonely, but that TSRQ may not explain changes in children's loneliness overtime. Further studies are needed to more fully understand the association between TSRQ and loneliness.

Session IV - D

Shopping for a Soup Kitchen: Factors Contributing to Attendance

Allie Arnette
Faculty Mentor: Dr. Carole R. Myers
Nursing

Food insecurity has become a growing problem in the United States (US); soup kitchens play an important role in feeding those who are not able to fully provide for themselves. In any given community, soup kitchens or food shelters exist for citizens in need. Many factors determine why people frequent certain soup kitchens. The literature contains information about the importance of an organization's ability to create a culture as well as the role an organization plays in helping clients meet their hierarchy of needs. A gap in the literature exists by failing to describe the specifics of organizational culture associated with soup kitchens. This literature review is compiled in order to assess a soup kitchen to further explore the importance of organizational culture via various aspects of services through the lens of Maslow's Hierarchy of Needs. This information may assist other organizations in making adaptations in order to best fulfill clients' needs. If society can better care for its vulnerable populations by ensuring their basic needs are met, an increase in overall health and a decrease in illness and hospitalizations may follow.

Integration of Spatial and Continuous Water Parameter Measurement with Existing Aquatic Habitat and Streambank Mapping Systems

William Barbour
Faculty Mentor: Dr. Paul Ayers
Biosystems Engineering

Traditional water quality measurement techniques have evolved from ex-situ testing to multi-parameter in-situ testing of spatially discrete or temporally continuous samples. The next advancement of these techniques seeks to achieve spatially continuous sampling. By incorporating multi-parameter measurement into an existing spatially continuous river surveying platform with GPS location, a water quality map can be generated for any body of water. This project integrated a YSI 6920 Compact Sonde into the techniques of the streambank mapping platform previously developed at the University of Tennessee, Knoxville. For proof of concept, a section of the Tennessee River, specifically the confluence of the Holston River and French Broad River, was mapped via cross sections across the mixing zone. The intention was to assess water quality parameters at a point where differences in the two influents would be apparent. The expectation, and reality, is that the distinction between influents would become less distinct further from the confluence. A GIS plot of various parameters will be presented and demonstrates the gradient change across multiple river cross-sections, while supporting the anticipated pattern of the mixing zone; differing water quality between the Holston and French Broad Rivers will also be compared. Resultant data and the feasibility of collection support the continued use of multi-parameter water quality units with spatially continuous data systems.

Translation Card Use at the Bedside: Communication between Spanish-speaking Families and Nurses in Pediatric Acute Care

Kylie Slayden
Faculty Mentor: Dr. Sandy Mixer
Nursing

The growing number of Spanish-speakers in the U.S. poses distinct communication challenges to health care institutions. Language barriers (LB) in health care have been associated with adverse events and poor outcomes during hospital stays, indicating the significant impact of LBs on patient safety. Although current strategies such as in-person and telephonic interpreters exist, little is known about their efficacy in reducing deficits in communication. Health care facilities in the East Tennessee region and nationwide are investing in medical interpretation services to provide care consistent with the patient's primary language. Yet the pattern of interpreter use among hospital staff is disjointed and LBs remain, raising concerns of safety and quality of care. Nurses may often be without interpreter support during daily bedside care of limited English-proficient patients and little is known about communication between nurses and these patients and families. Therefore, a qualitative descriptive research study will be undertaken to examine basic communication between nurses and Spanish-speaking limited English proficient family/guardians of pediatric patients at East Tennessee Children's Hospital following the development and piloting of a bedside translation tool. Findings may be important for understanding communication needs of these patients and others with limited English proficiency. In addition findings will serve as a reference for future development and content of bedside communication tools.

Session V - A

Charge Transport in Imidazole-based Deep Eutectic Mixtures

Logan Terheggen
Faculty Mentor: Dr. Joshua Sangoro
Chemical Engineering

Deep Eutectic Mixtures of levulinic acid with a series of imidazoles are measured by broadband dielectric spectroscopy and differential scanning calorimetry to investigate the impact of alkyl substitutions on charge transport. An increase in conductivity is observed in each of the imidazoles upon addition of levulinic acid. However, the extent of increase is dependent upon the alkyl substitution on the imidazole ring. These results highlight the importance of molecular structure on hydrogen bonding and charge transport in deep eutectic mixtures.

3,4,4'-Trichlorocarbanilide Exposure Induces Gut Microbial Dysbiosis in Weaned Rats

Russell Fling*, Rebekah Kennedy, Michael Robeson, David Bernie, Ling Zhao, & Jiangang Chen

Faculty Mentors: Dr. Jiangang Chen & Dr. Rebekah Kennedy
Microbiology

Widely used as an antimicrobial in bar soaps, triclocarban (3,4,4-trichlorocarbanilide; TCC) shows greater efficacy against gram positive bacteria than gram negative bacteria. This dichotomy may lead to overgrowth of bacterial populations less susceptible to the action of TCC. Sprague-Dawley (SD) rats were exposed to TCC (at 0.2% or 0.5% w/w) for 4 weeks starting on postnatal day (PND) 22 through the chow, followed by a washout period of 4 weeks without exposure. Same age SD rats served as sham controls without TCC exposure during the whole study period. Baseline samples were collected on PND 21 prior to the TCC exposure and collected weekly until the end of the study. Genomic DNA was extracted followed by PCR with barcode labeled primers targeting the v4 region of 16S rDNA. The barcode labeled PCR products were sequenced on the MiSeq platform. TCC exposure significantly altered GI tract microbiota composition, which was revealed by a dose-dependent overall bacterial community richness (ADONIS; $p \leq 0.001$). This perturbation was noticeable as early as two days post-treatment with approximately 16.5–18.6% of OTUs significantly enriched ($p \leq 0.05$) and continued throughout study period. At the community-level, TCC withdrawal produced a gradual return of microbial diversity to a pre-treatment state in the 0.2% w/w group, but not 0.5% w/w group as assessed by weighted Unifrac distance metric. Collectively, these data highlight the present and long term impacts of early life TCC exposure on gut microbial ecology and imply the potential niche for opportunistic pathogen growth due to alteration of microbiota composition by antimicrobials.

Grouping Digits as a Method for Increasing Computation Speed of Galois Field Arithmetic for Erasure Coding Applications

John Burnum
Faculty Mentor: Dr. James Plank
Computer Science & Physics

Digital data storage has been an important advance in the storage of information, but computer systems are not infallible and may fail, which may cause the data to be erased. The simplest way to protect data is to simply make duplicates of it. A far stronger method of protection is to encode the data in more memory but with connections between the different regions of the data, which allows for reconstruction of missing sections. This method is called erasure coding. One specific technique of erasure coding is Reed-Solomon coding. Reed-Solomon coding relies on finite field arithmetic to manipulate the data during the encoding process. This arithmetic must be very fast for Reed-Solomon coding to be practical, because to read or modify encoded data, it must be decoded and then encoded again afterwards, a time-consuming process. There are several methods of accelerating finite field computations. One simple strategy is to store partial steps of the computation in a look-up table to reduce the number of computations required. This method is sometimes known as grouping digits. In Galois Field arithmetic, the grouping digits method requires two different tables to be built, a multiply table and a reduce table. Each one relates some number of bits with a product. This work explores the parameter space

of the grouping digits method by varying the number of digits in each table and the size of the memory regions being multiplied and studies the differences in set-up computation, memory required, and main computation.

Session V - B

Understanding Social Presence and Subject Position in Online Environments

Michael Miceli
Faculty Mentor: Dr. Sebastien Dubreil
Linguistics

Within various fields of linguistics, language is perceived as a social mechanism, always carrying the meanings and values of communities, social groups, networks, culture, and identity. Language is at the heart of our interaction with the world around us. In a gaming environment, this translates in discursively created actions and interactions that regulate the relationships between players and, consequently, the outcome of the game. In order to be successful in such environments, players will need to develop a strong social presence, that is to say, the ability to project themselves through their characters in the social community and present themselves as 'real people'. By examining how players successfully navigate the game space by developing effective collaborative strategies and learning how to beat the game, this study will provide better understanding of the ecology of online learning. This could in turn have three important implications: (1) better understanding of how people do develop media literacy; (2) recommend how to best use media for education; and (3) insight into how to design technology-rich environments to achieve these first two goals.

A Critical Analysis of Immigration Detention in the United States

Valerie King
Faculty Mentor: Dr. Michelle Brown
Honors Sociology & Global Studies

In the United States and around the world, immigration increasingly intersects with criminal justice. Vast influxes in immigration are giving rise to anxieties about national identity, increased securitization, heightened border enforcement, and harsher punishments for illegal immigrants. Scholars refer to this phenomenon as "crimmigration". Immigrant detention is one manifestation of crimmigration. In 2012, the United States held 477,523 people in immigration detention centers, and expansion is on the rise. New facilities are being built to accommodate the increase in illegal immigration along the southwest border. For example, the largest detention center in the country, South Texas Family Residential Center, will detain up to 2400 women and children as they await deportation proceedings. Asylum-seekers, refugees, and others are subject to the often-desolate conditions of unregulated detention centers while, at the same time, having to contend with precarious legal statuses. This research outlines immigration detention in the United States and examines the social implications of the practice. I suggest that immigrant detention poses challenges for the treatment of immigrants in the United States.

Analyzing Kripke's Interpretation of Wittgenstein's Rule-Following Paradox

Will Coker
Philosophy

This presentation analyzes Saul Kripke's interpretation of Ludwig Wittgenstein's rule-following paradox. In Wittgenstein's *Philosophical Investigations*, he proposes a paradox that questions the notion of whether it is possible for actions to be determined by rules. Kripke, in *Wittgenstein on Rules and Private Language*, interprets this paradox to be Wittgenstein's skeptical argument against the possibility of meaning in language. Specifically, he claims that Wittgenstein's belief is that the meanings of words come from interpretations of rules. Therefore, according to the rule-following paradox, he states that Wittgenstein argues that meaning cannot be determined at all. In this presentation, I argue that Kripke's interpretation of the rule-following paradox is not Wittgenstein's actual belief, as evidenced by his writings in *Philosophical Investigations*.

Session V - C

Development of Surrogate Nuclear Melt Glass Samples for Nuclear Forensics Applications

Colton Oldham
Faculty Mentors: Dr. Howard Hall & Dr. John D. Auxier II
Nuclear Engineering & Chemistry

Nuclear melt glass, discovered as a byproduct during the Trinity test in 1945, is known to contain fission and activation products that hold key signatures from the fuel and tamper components. Due to this, samples of synthetic melt glass were developed and created, then analyzed to determine if they could serve as accurate surrogates for the nuclear forensics community. By determining the major soil constituents found in Alamogordo, NM, USA and adding small amounts of uranyl nitrate, the synthetic trinitite recipe was developed to create the sample matrix. Although these samples provide a suitable surrogate for accurate forensic separation techniques, highly populated urban areas hold the highest risk of a nuclear attack. With the current absence of urban melt glass for analysis, there is a need for accurate surrogate urban debris. Samples were then synthesized that were elementally similar to the urban environments of Houston, TX, USA and New York City, NY, USA, by determining the major soil, vehicle, and infrastructure constituents. These locations were chosen as they can suitably represent the range of elemental compositions found in the majority of urban USA locations. Half gram to gram quantities of each matrix were then melted in a high temperature drop furnace, removed quickly, quenched in a sand bath, yielding glass beads similar to that of previous synthetic trinitite samples. All samples were then analyzed via a variety of analytical methods, and it was determined that the synthetic samples produced could serve as a suitable surrogate for the nuclear forensics community.

Enzyme Mutant Purification Via Affinity Chromatography

Leah Parks
Faculty Mentor: Dr. Eric Boder
Biomolecular Engineering

The photosynthetic energy pathway converting solar energy to chemical energy may be isolated and manipulated into a usable, renewable energy source by isolating Photosystem I. In the presence of specific amino acid tags the enzyme sortase immobilizes Photosystem I to an electrode. Sortases that can recognize different tags would be useful for constructing protein assemblies. Mutant strains have been developed that are fully functional in attaching photosystem I to a surface. However, in order to make an enzymological characterization the mutants require challenging purification. Affinity chromatography is used to purify the mutant strains of sortase. To obtain mutants pure enough for surface experiments, E.coli containing plasmids encoding said mutants must be cultured in appropriate media, the protein expressed, separated from insoluble cellular material, and isolated based on affinity to resin. Differing concentrations of imidazole solution passed through the protein-bound resin result in elutions with differing concentrations of desired sortase mutants and evidence of additional undesired, unknown protein products. Culturing conditions and elution imidazole concentration can be modified to optimize sortase yield.

Characterization of Autocatalytic Activation of Influenza Hemagglutinin

Marti Bell
Faculty Mentor: Dr. Eric Boder
Chemical and Biomolecular Engineering

Influenza is a pathogenic virus with various human and avian subtypes. In influenza, there is hemagglutinin (HA), a membrane protein. HA sits on the surface of the virus in an inactive state with its fusion peptide embedded within the protein. Once the virus with the HA encounters a decrease in pH (within cellular endosomes), then the protein will go through an irreversible change in structure. A 20-amino acid "fusion peptide" sequence relocates and becomes exposed. Once this occurs, the viral and endosomal membranes fuse, allowing infection of the cell. If the dynamics and function of this virus-cell interaction can be understood, then it could be applied to the prevention of influenza infection and proliferation or could potentially be applied to drug or gene delivery using lipid vesicles. Once the hemagglutinin is activated by an acidic environment, the sequence of the fusion peptide is exposed. Using site directed mutagenesis, the sequence of the fusion peptide has been changed to a peptide sequence of CCXXCC (tetra-Cys), which binds to a reagent called FIAsH, inducing it to become fluorescent. Tetra-Cys tagged HA proteins were expressed recombinantly in transfected Chinese hamster ovary cells, and fluorescent video microscopy was used to observe the dynamics of the HA structural change and the location of the protein within the cell. After creating various mutants, a trend is seen in the dynamics of activation of the protein. A 5-minute time length of low pH exposure is necessary for the activation of a few HA on the cell surface. However even after the removal of the low pH environment, HA still continues to activate on the cell surface. Also, it was further seen that even in the absence of a low pH pulse, incubation in the presence of FIAsH induces the HA structural change within approximately 7 minutes, suggesting that FIAsH-mediated extrusion of the fusion peptide region is sufficient to induce HA activation. Funding provided by the RISER program and grant CBET-1264506 from the National Science Foundation.

Session V - D

Impact of Hospital-Associated Sitters in Care of Unattended Pediatric Patients

Michael Moore
Faculty Mentor: Tami Bland
Nursing

The issue of caregiver absence during a child's hospital stay has been a longstanding clinical challenge. This project will explore the new "Patient Pals" program at East Tennessee Children's Hospital. This program uses hospital volunteers for surrogate supervision during the temporary absence of the patient's caregivers during an inpatient hospital stay. The purpose of this presentation is to share the state of the science regarding the effects of unaccompanied children in the inpatient setting and a research design exploring the benefits of hospital-associated sitters for hospital staff and patient families. A review of literature was conducted using online databases such as CINAHL and PubMed identifying key literature. Previous research has demonstrated that the situation of caring for unattended pediatric patients increases nurse workload and emotional strain. Adverse patient health outcomes, such as increased anxiety, blood pressure and respiratory complications from crying, and fall risk, have been well documented. However, a significant gap exists regarding the affects of hospital-associated sitters on the staff and parents perceptions of this service. As such, the author has designed a quantitative investigation to address this gap. Data from this project will provide the foundation for increased hospital support for programs such as the "Patient Pals."

Immune Overload? Parental Attitudes towards Combination and Single Antigen Vaccines

Ella Hulseley
Faculty Mentor: Tami Bland
Nursing

Parental concerns have led to a recent decline in immunization coverage, resulting in outbreaks of diseases that were once under control in the US. As the CDC vaccination schedule continues to increase in complexity, the number of required injections per office visit increases as well. Some parents perceive that there is trauma associated with the administration of multiple injections, and research shows that having multiple vaccines due in a single visit is associated with delays and lower immunization rates. Combination vaccines make vaccination more efficient by incorporating the antigens of several different diseases into a single injection, but many parents worry that they may overload the child's developing immune system and leave him or her susceptible to secondary infections. This study aims to elucidate the scope and nature of these fears through a descriptive survey distributed to 100 parents of children aged 6 and younger. Parents were asked about their opinions regarding combination and single antigen vaccines, and how these opinions affect their vaccination practices. The results of this survey allow practitioners to more directly address parental concerns and provide specific educational materials to allay their fears.

Body Image, Physical Activity and Self-Concept in African American Adolescent Females

Jordan Casady
Faculty Mentor: Dr. Polly McArthur
Nursing

Childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years. This epidemic has both immediate and long-term effects on health and well-being. Disparities in childhood obesity are more prevalent in minority populations, particularly African Americans (AA). Research supports that lifestyle choices and habits pursued in adolescence are a precursor to adult behavior, making physical activity (PA) interventions during the adolescence pivotal to leading a healthy lifestyle. Many community-based programs have been established to address the promotion of physical activity, self-perception, and nutrition. Further, evidence exists that suggests AA women view the ideal body image as more voluptuous, resulting in a predominance of a higher BMI. Little is known about the relationship between perceived body image and participation in PA among AA females. An additional gap in the literature exists relating to perceived body image among AA adolescent females and how it relates to participation in PA. As such, a study will be undertaken to explore the influence of body image on PA. Findings from this study will help healthcare providers better understand the relationship between body image and participation in PA in order to help tailor interventions to this unique population.

Session VI - A

The Development of Object Play Interactions in Puppies

Jordan Herche*, Atira Sherrod*, Sean Stapleton*, Julia Albright, & Karen Davis

Faculty Mentors: Dr. Karen Davis & Dr. Julie Albright
Ecology and Evolutionary Biology; Microbiology; Animal Science

In domestic dogs, objects (toys) are often provided as sources of enrichment. However, the development of object play behavior in very young puppies has not been systematically documented across breeds. We conducted research to understand the emergence and changes in object play behavior over the course of puppy development. Here we examined object play behavior in two litters (7 pups each) of Vizsla puppies twice a week from three weeks of age to seven weeks of age. Each litter was presented with their own set of five types of toys, and the pups were video-recorded in their home enclosures for 90 minutes. For the first 10 minutes after the toys were introduced, the puppies' behaviors were observed and recorded from the video files using the Noldus Observer XT system. The two litters' object play interactions were analyzed based on three measures: duration of interactions, latency to begin interactions, and total number of interactions. For both litters, we found significant changes in all three of these measures, with total duration of play and average number of interactions increasing with litter age, and latency to interact with objects decreasing with age. We also found significant preferences among toys including preference for softer, stuffed toys over hard rubber toys as well as increased presence of social tug-of-war play with rope-like objects developing over time. We discuss also how the development of object play seems to differ in puppies from that of kittens.

Identification of High Frequency Conjugation Factors for *Campylobacter jejuni*

Devarshi Ardeshta
Faculty Mentor: Dr. Jun Lin
Neuroscience

Conjugation is an important horizontal gene transfer mechanism in bacteria. These genetic transfers might result in the observed huge diversity in *Campylobacter jejuni* strains. Meanwhile, *C. jejuni* strains display considerable variations in conjugation efficiency, ranging from 2.2×10^{-4} CFU/recipient cell (high efficiency) for CG8486 to 6.3×10^{-8} CFU/recipient cell (low efficiency) for NCTC11168. To understand the underlying molecular mechanism behind high frequency conjugation (HFC), based on the recent progress in the mechanism of natural transformation, a unique two-step screening (Co-transformation) method was designed. First, *chuB::erm* cassette was introduced in HFC strain CG8486 to bring in a co-transformation marker. And the first screening on erythromycin resistance was performed by using the genomic DNA of CG8486 *chuB::erm* mutant to naturally transform the low frequency conjugation strain NCTC11168, generating a library consisting of 2500 mutants. Any potential differentially existing genes between CG8486 and NCTC 11168 might be co-transformed with *chuB::erm* into the mutant(s) in this library, including HFC factors. Then the library was subject to the second screening for HFC phenotype. A total of nine HFC NCTC11168 derivatives were identified and confirmed by plasmid cure. Complete genome sequencing was done on six HFC derivatives and 2 low frequency derivatives using MiSeq. The subsequent comparative genomics analysis revealed a fused restriction-modification gene *Cj1051c* was responsible for HFC in *C. jejuni*. In summary, this study validates a unique co-transformation strategy to identify factors required for HFC in *C. jejuni*, established a solid foundation for us to elucidate molecular mechanisms of conjugative gene transfers in the future.

Peer Assisted Writing Strategy

Mary Neal
Faculty Mentor: Melissa Martin
Special Education

With the implementation of the Common Core State Standards (CCSS) and the new Partnership for Assessment of Readiness of College and Careers (PARCC) assessment, writing instruction has become a topic on the nation stage. Students will now be required to express their responses more in writing. This increased pressure to explicitly teach writing strategies will require supplemental implementation of research-based interventions that target written expression in the classroom.

The statistics regarding the proficiency of student writers enrolled in public schools nationwide are dismal, with only 23 percent of fourth graders, 26 percent of eighth graders, and 22 percent of twelfth graders considered proficient writers (Troia, 2002). Moreover, students with disabilities perform below their same-aged peers in all areas of writing (Graham & Harris, 2013). These students typically struggle in all five areas of writing (e.g. prewriting, drafting, revising).

The purpose of this study was to provide general education teachers a supplemental writing strategy that will increase the writing skills of upper elementary students. This scripted writing intervention provides prompts to complete the stages of the writing process with a peer. This strategy increases students' awareness to assess how effectively

the topic was developed, the effectiveness of textual evidence, the organization of the writing, and the use of correct conventions throughout the writing.

This intervention was implemented with four fourth graders with learning disabilities in a rural elementary school. After baseline data were collected, students were paired with typically-achieving writers to complete this intervention each week. Informational prompts were provided to students based on fourth grade science and social studies standards. Each pair read a small passage and then answered the prompt using the texts. This was an important component because citing textual evidence is one of the new foci of the CCSS. Texts were read out loud through the use of audio recorders and students were asked to complete a minimum of one prompt per week. At least two weeks after intervention, students completed the maintenance phase to assess the effectiveness of this intervention. Results indicate that providing students a peer-assisted strategy improves writing skills for students with learning disabilities.

Session VI - B

Ida B. Wells: A Method of Advocacy Journalism

R.J. Vogt

Faculty Mentor: Dr. Amber Roessner
College Scholars: Advocacy Journalism

In today's media world, ethical standards are evolving; the old reliance on "objective" reporting has been replaced by a responsibility to "be transparent" about one's motives. The result has been a resurgence of advocacy journalism, a form of journalism which endeavors to be fact-based but approaches the news from a specific viewpoint. This style of journalism dates to the early 19th century, having been known as Yellow Journalism, Radical Journalism and Activist Journalism throughout the last 200 years. Through an analysis of the work of Ida B. Wells during the turn of the 20th century, I show that advocacy journalism is best practiced with a certain methodology. Whether she was advocating for an end to lynching, a start to women's suffrage, or for the local black community, Wells' journalism invariably contained three tenants: the demonstrative use of facts and details, the recommending of a solution to the conflict, and appeals to diverse audiences.

Rediscovering Latin America: Hegemony and Othering in Latin American Studies

Melanie Marquez
English

For over a century, Latin American literary works have been understood and read as a set of allegories with echoes of Western literature. In his essay "Third-World Literature in an Era of Multinational Capitalism," literary critic Fredric Jameson argues that unlike the literatures of the First World, Third-World literatures must be read as national allegories. For Jameson, "the story of the private individual destiny is always an allegory of the embattled situation of the public third world culture and society." Critic Erna von der Walde disagrees with the ideas expressed in Jameson's essay and points out that they lead to closed cultural spaces where the First-World reader and the 'other' seem to be unable to connect. She criticizes Jameson's use of the term 'world' as it transforms nations into

isolated and disengaged units. Furthermore, although Latin American writers might find in Western texts sources of inspiration, how they interact with them from their own cultures and motivations, grant their creations a distinctive nature. Texts should be freed from the brand of imitation, so that they can be read with a fresh perspective. Internationally recognized literary pieces produced in Latin America should not have to owe any loyalty to their literary predecessors any more than other contemporary Western texts. This paper is an invitation to reflect on the state of Latin American Studies in the United States with a critical view of the discourse of 'othering' as detrimental to a productive and critical understanding of the rapidly changing reality of Latin America.

The Mysterious Case of Benton and Gould: America Today and Dick Tracy as Documents of the Great Depression

Melinda Narro
Faculty Mentor: Dr. Mary Campbell
Art History

My research explores the close connections that run between American Regionalist art and newspaper adventure comics during the 1930s using Thomas Hart Benton's *America Today* mural (1930-31) and Chester Gould's *Dick Tracy* strip (1931). These concurrent popular movements each represent a seismic shift in the tone of their medium when compared to that of the 1920s. Within these two works, repeated patterns of form and content attest to a shared purpose rooted in the national malaise of the early Depression. Granted parity as valuable historic documents, both *America Today* and *Dick Tracy* speak clearly to the desires, frustrations, and fears of a country in crisis. Further critical reading reveals how Benton and Gould achieved similar levels of popular acclaim by offering the public visual and narrative affirmations of American unity, ingenuity, and strength. The cultural insight gleaned in such an exercise argues for a more holistic approach to art history that eschews "high" and "low" artistic distinctions.

Session VI - C

Educational Atmospheres within University Classrooms: A Cross-cultural Examination of French and American Colleges

Alex Brito & Rebecca Groh
Faculty Mentors: Dr. Sebastien Dubreil & Dr. Julie Albright
College Scholars: Neuroscience, Neurolinguistics, and French; Geography
& French and Francophone Studies

This project explored the educational atmosphere within university classrooms in France and the United States by focusing on the relationships between students and professors, students and TAs/chargés de TD, and among peers. This study was conducted in response to Coulon and Paivandi (2008) in which French professors were described as distant, cold, and unsociable. Points of inquiry were centered around pedagogical methods, collective classroom activities, and students' feelings toward group work. Finally, conclusions were drawn regarding the advantages and disadvantages associated with each environment (French or American) vis à vis the happiness and success of its students. Surveys (n=203) and interviews (n=5) provided quantitative and qualitative data, resulting in a holistic examination of the topic. Results obtained from student to student interactions showed

that American students tended to have a more individualistic approach to their education. In regards to student-professor relationships, American students and professors tended to interact outside of the classroom more frequently than their French counterparts. Furthermore, American professors were more likely to learn students' names and were more inclined to talk about non-academic topics with students. The interactions between students and TAs/chargés de TD were comparable in both settings although TAs tended to be more relaxed in both teaching attire and demeanor.

This study serves as a tool for students and professors learning and educating in diverse environments by providing a cultural awareness of university norms and elucidating the challenges of cross-cultural comparisons.

Using SPLASH to Visualize Nucleosynthesis of Many Species in CHIMERA Simulation of Type IIA Supernovae Core Collapse

Amos Manneschmidt
Faculty Mentor: Dr. Raph Hix
Physics

One of the goals of cosmology is accounting for how everything we see came to be in the abundances observed. A major contributor to the generation of many of the elements essential to life on earth is supernova. Theories of nucleosynthesis are tested by comparison of dependent simulation data to observation. In the CHIMERA project, the propagation and generation of numerous species of elements are tracked using tracer particles each representative of a discrete chunk of mass. This allows the simulation to trace 150 different species in a radially symmetric regime. This project presents a simple way of visualizing that data as smoothed hydrodynamic data which can then be read by SPLASH, a tool for imaging just that. By inferring from geometry and relative position of each particle to its n th nearest neighbor, data necessary to visualization can be found such as corresponding smoothing lengths and densities. This result is compared to ideally equal data rendered directly by Chimera at higher resolutions. Upon sufficient agreement the low-resolution results are generated for species not rendered directly by Chimera due to excessive additional computational cost. Using these results predictions can be made about the end state of any of the 150 elemental species.

Optimization of Fission Yeast Lipogenesis for Increased Biofuel Production

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Biomolecular Engineering

The feasibility of biofuels as an efficient source of energy relies heavily on the capability of biosynthetic organisms to produce metabolites needed for biofuel production at a high yield. To date, the utilization of fission yeast as a biodiesel producing platform has yet to be fully investigated, so here we genetically engineered *S. pombe*, to achieve higher capacities of de novo lipogenesis, specifically triacylglycerols (TAG), one of the main precursors to biofuels. The genetic targets for this work are *dga1*, *acc1*, and *are2*. *Dga1* and *Acc1* are heavily involved in the synthesis of lipids and are overexpressed with the P3nmt1 promoter in mutated strains. Because *Acc1p* is also involved in the production of sterol esters which is not optimal for biosynthetic fuel production, we deleted *are2*,

which catalyzes the ultimate step of sterol ester synthesis, thus redirecting precursor molecules towards further TAG production.

Can Mirror Matter Be Detected on Earth?

Louis Varriano
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Physics

A precise measurement of the neutron lifetime is important for calculating the rate at which nucleosynthesis occurred after the Big Bang. The history of neutron lifetime measurements has demonstrated impressive continuous improvement in experimental technique and in accuracy. However, two most precise recent measurements performed by different techniques differ by about 3 standard deviations. This difference of 9.2 seconds can possibly be resolved by future experiments, but it may also be evidence of a new effect. This research investigates the possibility of explaining this difference by a mirror matter effect present in these experiments. Both mirror matter, a candidate for dark matter, and ordinary matter can have similar properties and self-interactions but will interact only gravitationally with each other, in accordance with observational evidence of dark matter. Although mirror matter does not couple to ordinary matter by Standard Model interactions, some additional interactions might exist, providing small mixing of ordinary matter neutral states, like the neutron, with mirror components. This work estimates the density of mirror dark matter particles needed to explain the difference between these two measurements of the neutron lifetime. Working under an assumed accumulation of mirror dark matter particles within the Earth and using the 9.2 s difference in the neutron lifetime observed by the two mentioned experiments, we can estimate the possible density of dark matter on the surface of Earth. The measured neutron lifetime difference thus might be an indication of the presence of dark matter on Earth. The parameter space is analyzed for both the mirror dark matter case and the mirror dark antimatter case. This work is part of a paper being prepared for publication in collaboration with Prof. Z. Berezhiani (University of L'Aquila, Italy) and Prof. Y. Kamyshkov (University of Tennessee).

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Married and Unmarried Cohabitation Impact on Maternal Reproductive Behaviors and Neonatal Health Factors

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Nursing

There has been a rapid increase in the number of unmarried couples that participate in the same family practices as their married counterparts such as having children and cohabiting in the same residence. Unmarried cohabiting mothers are at a higher risk of smoking, experiencing symptoms of depression and having more stressful pregnancies than married cohabiting mothers. These conditions place the neonates of unmarried cohabiting mothers at an increased risk for low birth weight, low Apgar scores and low gestational age. Such findings suggest that these unmarried cohabiting mothers and their neonates are not receiving the proper support required during pregnancy. Perhaps the effect of being in a legally sanctioned union such as marriage has a health promotional effect on maternal reproductive health behaviors and neonatal health factors. Failure to recognize and/or understand this effect can possibly contribute to adverse health effects. Therefore, the purpose of this presentation is to lay the foundations of a proposed project that will explore the perceptions of unmarried and married cohabiting mothers about maternal reproductive health behaviors and the effect of these perceptions upon neonatal health factors. This information will be instrumental in promoting appropriate antenatal care practices for healthy pregnancies and neonatal health factors.

Agonistic Behaviors and Dominance Hierarchy in *Pseudemys concinna*

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Faculty Mentors: Dr. Gordon Burghardt & Dr. Karen M. Davis
Biology; Animal Science & Biological Sciences; Animal Science, Biological Sciences & Food and Agricultural Business; Ecology and Evolutionary Biology

Agonistic behaviors are important in establishing social hierarchy relationships within a group. To examine factors involved in dominance hierarchy within a population of turtles, we observed videos of dyadic agonistic interactions in four male River Cooters, *Pseudemys concinna*, from spring to fall in a large naturalistic mixed-species exhibit at the Tennessee Aquarium in Chattanooga. Video recordings were made of interactions through an underwater glass viewing area. Three of the males were residents in this exhibit with a fourth introduced in the fall. This allowed for studying the effect of a new animal on the social structure. An ethogram of the turtles' agonistic behavior was developed, and coded from the videos using the Noldus Observer XT program. Offensive behaviors such as snaps and gapes were generally performed at the beginning of an interaction by the turtle who eventually 'won' the dispute. At the end of an interaction, either both turtles swam away (winner and loser undetermined), the loser retreated, or the loser became still and retracted its limbs. Dominance was determined by the turtle who won the greatest percentage of contests. Higher ranking turtles were usually more aggressive. They were involved in, and initiated, more agonistic interactions than lower ranking turtles. Introduction of a new large male turtle caused an increase in overall number of agonistic encounters, with many interactions involving the new turtle, and resulted in the eventual

displacement of the second ranking turtle by the new male. Status between the highest ranking resident male and the new male remained unresolved. This research indicates that agonistic behaviors are best assessed underwater, are tightly related to dominance hierarchy, and introductions of new members can have a big impact on dominance hierarchy in turtles.

Biodiversity of Natural and Cultivated Plant Populations in Knoxville, Tennessee, and Its Correlation to the Frequency of Powdery Mildew Disease

Avanti Rangnekar

Faculty Mentors: Lisa Cantwell & Dr. Susan Riechert
Public Health

The presence and transmission of pathogens affects ecosystem health negatively (Diaz et al., 2001). Mounting evidence indicates that biodiversity loss frequently increases disease transmission. However areas with naturally high biodiversity may serve as a source pool for new pathogens (Kessing et al., 2010). Powdery mildew, one of the most common types of fungal disease in plants can affect the majority of plants. We evaluated to see whether or not there was a correlation between biodiversity and the frequency of powdery mildew. Additionally our study analyzed the effects of natural and cultivated treatment groups, Ijams and a neighborhood in North Knoxville Tennessee respectively, on biodiversity and the frequency of powdery mildew. Genus and presence/absence of powdery mildew was evaluated in 220, 3-ft or taller plants within the two treatment groups. The cultivated treatment site showed significantly greater biodiversity when compared to the natural treatment site, however there was interestingly no significant effect of treatment group on the frequency of powdery mildew. Additionally, there was a negative correlation between biodiversity and powdery mildew frequency, however this correlation was not significant. We found that biodiversity explained 5.02% of the variation in the frequency of powdery mildew and was therefore an unreliable predictor of powdery mildew frequency. Our results are supported by previous research that indicates that biodiversity loss frequently increases disease transmission (Kessing et al., 2010). Our results warrant further studies.