Acknowledgements

The Center for Undergraduate Research would like to thank all of the participating students and mentors for their involvement with the 16th annual Undergraduate Research Symposium.

The Center staff would especially like to acknowledge the co-sponsorship of Research and Graduate Studies and the support from these outstanding KU organizations:

- College of Liberal Arts and Sciences
- Center for Civic and Social Responsibility
- Collaborative for Experiential Learning
- Global Scholars Program
- KU Chapter of Sigma Xi
- McNair Scholars Program
- Multicultural Scholars Program
- School of the Arts
- Office for Diversity in Science Training
- University Honors Program

In addition, we’d like to thank the following graduate students and postdoctoral researchers for their assistance in facilitating the day’s events:

Nichol Castro
Jacob Longaker
Stephen Politzer-Ahles
Mariad Cocke
Sonia M. Hall

Kathy Roccaforte
Amanda Hemmingsen
Caroline Porter
Ezekiel Stear
Nikki Galvis

Center for Undergraduate Research

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Faculty Fellow

John Augusto, PhD
Director

Nicole Perry
Assistant Director

Dyan Morgan, PhD
Program Coordinator
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Undergraduate Research Symposium Program
27 April 2013
University of Kansas, Kansas Union

12:00 – 12:50 – Registration (sign-in & name tags) – 4th Floor Lobby

1:00 – 1:30 – Opening Session – Alderson Auditorium

Welcome: John Augusto, Director, Center for Undergraduate Research

Opening Remarks: Chancellor Bernadette Gray-Little

Presentation: James K. Hitt Award for Outstanding Undergraduate Research

1:30-1:45 – Break

1:45-2:45 – Session I

Graduate Student Panel:

English Room: Using your Research Experience in the Social Sciences
Panelists: Nichol Castro, Psychology
           Jacob Longaker, Political Science
           Stephen Politzer-Ahles, Linguistics

Poster Sessions:

International Room: Creative Arts
Allison Brewer, Acetic Acid Off-Gassing in Clamshell Enclosures
Michael Burch, The Studio Pod: An Architectural Investigation of a Live/Work/Study Cubicle
Robert Healey, Lightweight Amplifiers for Acoustic Measurement and Electro-Acoustic systems
Sophia Hilleary, Designing for an Unstructured Play Experience

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by 🏆 in the program booklet.
Joe Krentz, Tibetan Vernacular and the Contemporary City
Brenna Paxton, INDEX
Mariah Trevizo, New Orleans Culinary Incubator: Experience, Integrate, Create

Parlors Room: STEM 1

Cody Alley, An Analysis of Environmental Factors Contributing to the Successful Population Growth of Sceliphron caementarium
Jason Bates, Mesoporous Solid Acid Catalysts for Alcohol Dehydration
Lauren Beesley, Dynamics and Detection of Mead's Milkweed
Alahna Broadway, Invasive species: introduction methods, impact, control methods
Corinne Edds, Intracellular Calcium Level Changes in Cultured Neurons Through Live Cell Calcium Imaging In Response to Thromboxane A2
Marcus Florez, Analysis of Mitochondrial Haplotypes, APOE and TOMM40 Genotype with Alzheimer's Disease
Kirsten King, Impacts of Teleconnection Patterns on Relative Spatial Distribution of Spring Tornadoes in the Contiguous U.S.
Samuel Long, Characterizing subcomplex formation in septate junction biogenesis in Drosophila embryonic tissues
Haley McKee, The Relationship between Sports Involvement and Spine Flexibility in Adolescents
Jennifer Mendez, An evaluation of Fasciclin 3 (Fas3) as a core component of the septate junction of Drosophila melanogaster
Mitchell Newton, Utilizing Microdialysis to Monitor Biomarkers In Vivo through Capillary Electrophoresis
Erin Reid, Separation Optimization of L-DOPA and its Metabolites Using Microchip Electrophoresis with Electrochemical Detection
Evan Reznicek, Analysis of Thermoelectric Devices as a Means of Condensing and Retaining Moisture
Christopher Trezza, The Genetics of the Maintenance of Single-Celled Tube Diameter in C. elegans
Julia Yang, Estimating populations of Osha, Ligusticum porteri, an important medicinal plant of the Southwest U.S.

Oral Presentations:

Alderson Auditorium: Hitt Award Presentations

Joshua Dean, Identifying Factors Affecting Student Transition from Primary to Secondary Education in Selected Developing Countries
Alex Kong, Evaluating the mechanism of α-tocopherol-mediated recovery of lysosomal impairments in neurodegenerative diseases
Kayci Vickers, Effects of Transcranial Direct Current Stimulation Over Prefrontal Cortex for Decision Making and Creative Problem Solving

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by 🥈 in the program booklet.
Big 12 Room: Psychology

Rachel Bruursema, Bio-Acoustical Neuromodulation for Phobia and Excessive Anxiety Reduction
Katherine Evans, How word-frequency influences word-learning
William Wright, The Effects of Stress-related Noradrenergic Changes on Attentional Selection and Flexible Thought

Centennial Room: Intersections of the Arts and Religion/Philosophy

Erin Fulton, Secular Repertoire in American Dispersed-Harmonic and Reform Tunebooks, 1820-1850
Stoney Weaver, Fallen Idols
Margaret Witzke, Sitayana Gonna Say Something?

Jayhawk Room: Social Issues and Public Policy

Alyssa Ong and Anthony Abay, Alternative Breaks: Their Impact on Students’ Perceptions, Attitudes and Behaviors
Kyle Patterson, The Magnet or the Men?: Path Dependence and Political Polarization Through the Prism of National Budgetary Disputes
Rachael Snider, Abortion Rhetoric and the Media

Malott Room: The Environment

Mugabi Byenka, E-waste: A necessary means to an end?
Rena Detrixhe, Bring to the Table
Daniel Kennedy, Design and Deployment of the Askaryan Radio Array South Pole Autonomous Renewable Power Stations

Pine Room: Biology

Tyler Darland, The Role of Mical within the UNC-6/Netrin signaling pathway
Joseph Kellum, Cooperation of L-Type and Cyclic Nucleotide-Gated Ca^{2+} Channels in Prolonging U-46619-Induced Vascular Contraction
Sebastian Schöneich, The role of CDH-4 in neuroblast migration in the nematode Caenorhabditis elegans

2:45-3:00 – Break

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by in the program booklet.
3:00-4:00 –Session II

Graduate Student Panel:

**English Room: Using your Research Experience in STEM Fields**

Panelists:  
- Mariad Cocke, Bioengineering  
- Sonia M. Hall, Molecular Biosciences  
- Kathy Roccaforte, Ecology and Evolutionary Biology

Poster Sessions:

**Parlors Room: Social Sciences**

- **Eric Adell**, The effect of stress and vowel quality on L2 Spanish learners’ perception of /d/ and /r/  
- **Andrew Jamison**, An ERP Study of Number Prediction in Noun Phrases  
- **Devin Lasley**, Employing a Sports Psychology Perspective to Assess an Athlete’s Experience Competing in a 100-Mile Race  
- **Wing Yan Lau**, Interpreting Conflicting Performance in a Masculine Domain: A Shifting Standards Approach  
- **Rubie Peters**, How Locus of Control Relates to One’s Knowledge and Perception of Evolution  
- **Arianna Morgart**, Gender and Maternal Responsivity as Factors in Number of Conversational Turns in Adolescents with Developmental Disabilities  
- **Haley Robb and Mallory Eddy**, Depression and Coping Mechanisms  
- **Bryce Tappan**, Mapping of Four Indigenous Tawahka Communities

Performances:

**Hawk’s Nest (First floor): Performances 1**

- **Brendan Allen**, Displaced Inspiration: How exposure into the unfamiliar galvanizes creative energy  
- **Jenny Curatola**, Performing Paley

Oral Presentations:

**Big 12 Room: The US Military Abroad**

- **Sarah Bregman**, Constructing Security on Jeju Island: An Analysis of Elite Rhetoric  
- **Christopher Farley**, Unit Cohesion: The Undiscussed Contributor to the My Lai Massacre  
- **Matthew Visser**, United States Intervention in Africa: The Legality of Building Nations

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by 🌟 in the program booklet.
Centennial Room: Ad Astra

Samantha Brunker, A Broad-Band Photometric Survey of the Open Cluster NGC 7789
Benjamin Hofmeier, Vernier Reaction Control System Reboost Translational Maneuver of the Hubble Space Telescope During STS-82
Samuel Wester, The Chelyabinsk Event: A Sobering Reminder

Jayhawk Room: Engineering

Henry Clever, Imaging Thin Films of Non-Newtonian Fluids
Myette Simpson, Understanding Spine Range of Motion in Correlation to Body Mass Index of Children
Haider Tarar, Designing Optimum Protein-Excipient Interactions using Molecular Docking Simulations

Malott Room: Bodies

Cynthia Brown, College Living Arrangements and Body Dissatisfaction: The Case for Males
Jennifer Geller, Bejeweled Bones: Examining shrines and the holy dead in the Medieval Christian tradition
Elizabeth Sims, Obsession: Body Alteration and Modification

Pine Room: Language and its Meaning

Rachel Brown, Assessing Preschool Children’s Knowledge of Complex Nouns from a Logico-Semantic Perspective
Bonnie Ewart-Fisher, Sexuality in Early Modern Japanese Society Through the Works of Saikaku
Ryan Smith, Concerning Hobbits: The Hobbit, The Lord of the Rings, and the Trauma of the 19th/20th Century Transition in English Culture

4:00-4:15 – Break

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by 🏊 in the program booklet.
Graduate Student Panel:

English Room: Using your Research Experience in the Humanities

Panelists: Amanda Hemmingsen, English
           Caroline Porter, English
           Ezekiel Stear, Spanish and Portugese

Poster Sessions:

Parlors Room: STEM 2

Lindsay Astleford, The Functional Role of Y201 in the Human Steroidogenic Cytochrome P450 17A1 Enzyme
Danse Bi, Application of Hetero-Michael Pathways for the Synthesis of Sultam Libraries
Jamie Branch, Tension-Displacement Properties of the Posterior Cruciate Ligament at Maximum Extension Angles
Kimberly Cole, Rotary Task Moment Analysis of the Lower Extremity after Total Knee Arthroplasty
Elizabeth Jarvis, Lethal phase and phenotypic analyses of a collection of prepupal lethal mutations in Drosophila melanogaster
Robert Knight, Delay Circuit for Doppler Shift Simulation
Jordan Koch, Algorithms for Calculating Pattern Class Probabilities on Phylogenetic Trees
Holly Lafferty, The Effects of Nutritional Stress on Nitrogen Stable Isotope Ratios in Minnows
Nilam Patel, Investigation of Biochemical Changes in Seizure Affected Brain Tissue
Alexandria Roy, Identification of miR-137 Targets in Colon Cancer
Kayla Sale, Comparing stomatal characters in glacial and modern conifer leaves
Liza Tauscher, Diversity Oriented Synthesis Strategies to Benzofused Sultam Libraries: Discovery of Small Molecule Modulators of Biological Pathways
Rodolfo Torres-Gavosto, Derivatization of the azulenic framework along its molecular axis for self-assembly on gold surfaces
Timothy Turkalo, Ewing’s sarcoma protein EWS regulates skeletogenesis
Mohan Zhang, Automated Microfluidic Femtoliter Array for Quantitative ELISA at the Attomolar Level

Performances:

Hawk’s Nest (First floor): Performances 2

Ian Cook, Vishuddha
Kel Woods, Echoes Through the Haze

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by 📖 in the program booklet.
Oral Presentations:

**Big 12 Room: Religion, Space, & Identity**
- Garrett Fugate, The Creation of Sacred Islamic Spaces out of non-Islamic Buildings
- Paul Thomas, Archaeological Survey of Center Chapel, Franklin County Kansas

**Centennial Room: Astronomy & Physics**
- Jackson Young, X-Ray Studies Of The Pixel Readout For The CMS Detector
- Amy Zheng, Surface Wave Propagation

**Jayhawk Room: Multiculturalism & Race**
- Allen Schaidle, Understanding Cultural Intelligence and Nurturing Global Consciousness

**Pine Room: Biomedical Research**
- Matthew Behymer, Investigating the Tight Junction Modulatory Activity of EC-4 Hexapeptides from E-cadherin
- Alexander Fondaw, Identifying Inhibitors of ZipA Through Computational and Biochemical Screening
- Spyros Siscos, Computerized Neurocognitive Assessment Tests and Detection of the Malingering Athlete

5:15-5:30 – Break

5:30 – Symposium Banquet, Kansas Room

*Welcome: John Augusto*, Director, Center for Undergraduate Research

*Presentation: 2013 K. Barbara Schowen Undergraduate Research Mentor Award*

Presentations under consideration for the Sigma Xi (science honors society) award are denoted by ☑ in the program booklet.
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2013 K. Barbara Schowen Undergraduate Research Mentor Award

The K. Barbara Schowen Undergraduate Research Mentor Award honors the contribution of outstanding undergraduate research mentors to their students' development and to their own discipline. The award recipient will be recognized at tonight’s banquet and will serve as a model to other mentors on campus on how to best support undergraduate research and creative scholarship on campus.

Research mentors are nominated through a two-part process: students, faculty, or staff submit recommendations for a mentor to be considered for the award, then home departments select one nominee and submit an application packet.

Below, you’ll find listed all of the outstanding research mentors nominated by their home departments for the 2013 Schowen Mentor Award:

- Elizabeth Asiedu, Economics
- Leslie Bennett, Theatre
- Nate Brunsell, Geography
- Robert Fiorentino, Linguistics
- Paula Fite, Clinical Child Psychology & Applied Behavioral Science
- Kathryn Gerry, Art History
- John Karanicolas, Molecular Biosciences
- Cima Katz, Visual Art
- Tracey LaPierre, Sociology
- Cheryl Lester, American Studies & English
- Adrian Melott, Physics & Astronomy
- Renee Perelmutter, Slavic Languages & Literatures
- Phil Vardiman, Health, Sport & Exercise Science
- Hongguo Xu, Math
The Center for Undergraduate Research is now accepting submissions for

**Undergraduate Travel Awards**

Applications considered each month while funds last

[www.ugresearch.ku.edu/travel](http://www.ugresearch.ku.edu/travel)
ABSTRACTS

Eric Adell
The effect of stress and vowel quality on L2 Spanish learners’ perception of /d/ and /ɾ/
Advisor: Jie Zhang, Linguistics

This study investigated the role that stress position and vowel context play in influencing the perception of the sounds d and r for English learners of Spanish. Due to the way that the sound systems of English and Spanish are organized, native English speakers who are learning Spanish often have difficulty in differentiating the Spanish sounds d and r. The problem for English speakers is that in circumstances where English d is pronounced as r, Spanish d never is, and Spanish r occurs in environments where it never can in English. The realization of the English sounds can generally be predicted based on where stress falls relative to the sound in question. Previous research has also suggested that the quality of the adjacent vowels plays a role in determining the English realization of these sounds. Due to their effects on English production of d and r, stress position and vowel context were predicted to affect the perception of their Spanish counterparts. Two groups of English learners and a native Spanish control group were tested. Subjects performed a perception judgment task which targeted the sounds d and r, in which both the position of primary lexical stress and adjacent vowel quality were controlled for. The results of the study suggest that both stress position and adjacent vowel quality indeed influence the way that English speakers perceive Spanish d and r. Although differing significantly in overall performance, the error patterns between the beginner and advanced groups were strikingly consistent.

Brendan Allen
Displaced Inspiration: How exposure into the unfamiliar galvanizes creative energy
Advisor: Megan Kaminski, English

Poetry, along with other forms of artistic expression, can shift a reader's frame of mind by providing a glimpse into the “other,” that is, an image, idea, or environment that challenges one's internalized norms. However, before such work can be created authentically, it is often essential for the author to experience a shift in mind for him or herself – the process of a poem’s realization is just as integral to its effectiveness as its delivery. Effective writing emerges when authors can draw upon events and moments that have changed the way they see the world. The poems that I will be reading emerged from situations in which I displaced myself (physically/geographically/socially) in order to experience the sensation of becoming the "other." This self-inflicted displacement creates a vulnerable, honed awareness of surroundings - a state that allows for the recognition (and, potentially, enhancement) of the subtle connections throughout our surrounding world. In turn, the content of my poetry "twists" places in which we often feel most comfortable, such as the home, the body, and the social group, with the aim to extend the sensation of
displacement that I find integral to creative production. This project includes creative research conducted through my UGRA-funded experience surrounding the 2012 Summer Writing Program at Naropa University in Boulder, Colorado, as well as material that grew from my 2012 Honors English Proseminar: Literature and the Life Course. Themes include the home, the body, geography, ecology, social interaction and the diversity of the life course.

Cody Alley
An analysis of environmental factors contributing to the successful population growth of *Sceliphron caementarium*
Advisor: Robert Ward, Molecular Biosciences

Wasps are a diverse group of insects that have inhabited earth for millions of years. Of the numerous species of wasps identified, many are considered predators, parasites, or pests. Understanding what is required for the survival of these organisms is important due to their environmental role in reducing insect pest populations. This study aims to understand the requirements for successful population growth relative to the proximity of resources using *Sceliphron caementarium* as a model organism. *S. caementarium* is known to build nests under bridges in close proximity to the muddy banks of waterways to protect the nest from damaging water penetration. This project utilized a systematic approach to collect representative nests from a natural population of *S. caementarium* in Douglas, Jefferson, and Johnson Counties of northeastern Kansas. The collected specimens were then dissected and examined. The findings were documented and the condition of the offspring was catalogued. This analysis provides insight into the requirements for successful population growth or factors contributing to population reduction of *S. caementarium*.

Lindsay Astleford
The Functional Role of Y201 in the Human Steroidogenic Cytochrome P450 17A1 Enzyme
Advisor: Emily Scott, Medicinal Chemistry

Cytochrome P450 17A1 (CYP17A1) is a monooxygenase heme protein involved in synthesis of human steroid hormones. CYP17A1 performs two principal reactions that interconvert steroids. CYP17A1 first converts pregnenolone or progesterone to respective 17α-hydroxylated products that are precursors of corticosteroids, androgens, and estrogens. A subsequent CYP17A1 17,20-lyase reaction converts 17α-hydroxypregnenolone to the androgen dehydroepiandrosterone. Androgen or estrogen promotes growth of prostate and breast cancer, respectively and thus inhibition of CYP17A1 is a promising target for both steroid hormone-responsive cancers. The only marketed CYP17A1 inhibitor, abiraterone acetate (Zytiga®), blocks 17α-hydroxylase and 17,20-lyase reactions. Selective inhibition of the 17,20-lyase reaction is desirable to effectively block androgen and estrogen production without the
side effects observed from inhibition of the hydroxylase reaction and glucocorticoid synthesis. The CYP17A1 active site residue Y201 was recently observed to participate in binding of abiraterone via a hydrogen bonding network. The mutation of this tyrosine to asparagine (Y201N) has been reported to reduce 17α-hydroxylase and 17,20-lyase activities in a human patient, suggesting a catalytic role. Site-directed mutagenesis was used to evaluate this role by first generating a conservative mutation, eliminating the tyrosine hydroxyl group (Y201F). The effect of the Y201F mutation on binding of typical substrates to recombinant purified CYP17A1/Y201F protein was minimal compared to the wild type enzyme. Studies evaluating CYP17A1/Y201F ability to convert progesterone to 17α-hydroxyprogesterone via the 17α-hydroxylase reaction found the Y201F mutant functioned similarly to the wild type enzyme. Overall, this suggests the hydroxyl group of tyrosine 201 does not play a substantial role in substrate binding or metabolism in CYP17A1.

**Jason Bates**
Mesoporous Solid Acid Catalysts for Alcohol Dehydration
Advisor: Bala Subramaniam, Chemical and Petroleum Engineering

The selective dehydration of alcohols is one possible pathway for adding value to biorenewable feedstocks. Current solid-acid catalysts can effectively dehydrate small substrates, but novel catalysts must be developed to accommodate the larger size of biomass substrates. Researchers at the KU Center for Environmentally Beneficial Catalysis (CEBC) have developed a solid-acid catalyst called Zr-KIT-6 whose mesoporous silicate structure should facilitate reaction with larger substrates. In previous experiments, Zr-KIT-6 has been shown to have the necessary acidity to selectively dehydrate both ethanol and 2-propanol at high conversions. This work extends the investigation to include a larger substrate: 2-butanol. Reactions were performed in a packed-bed reactor. Conversion data at varying temperatures will be used to analyze the intrinsic kinetics of the reaction and determine kinetic parameters. Quantification of the products using a gas chromatograph will be performed in order to determine product selectivities. Catalyst deactivation will also be investigated, as well as the effect of acidity on the conversion and selectivity.

**Lauren Beesley**
Dynamics and Detection of Mead’s Milkweed
Advisor: Helen Alexander, Ecology and Evolutionary Biology

Field studies on plants that are monitored through time are central to understanding population dynamics. However, incomplete or inaccurate detection can lead to biases in raw counts and estimates of plant survival. Factors such as a plant’s size, flowering state, and land management may affect a plant’s detectability. In order to better understand survival and overall population dynamics of *Asclepias meadii*, a rare prairie perennial also known as Mead’s Milkweed, we
considered a four-year mark-recapture study. Through the program MARK, we used mathematical models which can account for incomplete detection. Using a patch’s average number of stems as a covariate, we explored how patch size, flowering state, and land management will impact a patch’s survival and detectability. Additionally, we estimated overall population growth. Although we were not surprised to find that both survival and detection increased with increasing patch size, we did find that the probability of state change was also affected by patch size. The probability of a nonflowering patch becoming a flowering patch increased with patch size. Similarly, we found that the larger the patch, the larger the tendency to remain in a flowering state. Finally, we found an overall population growth rate of 0.989 (95% CI: 0.979, 1.000). This suggests that the overall population size is declining slightly. These results are of particular importance to conservation efforts of Mead’s Milkweed and, additionally, allow us to better understand and quantify incomplete detection in field studies.

**Matthew Behymer**

Investigating the Tight Junction Modulatory Activity of EC-4 Hexapeptides from E-cadherin

Advisor: Teruna Siahaan, Pharmaceutical Chemistry

The long-term goal of this project is to improve the efficacy and specificity of E-cadherin derived peptides to modulate the intercellular junctions of MDCK cell monolayers in vitro model for the BBB. Transepithelial electrical resistance (TEER) is used to evaluate the efficacy of the peptides to modulate cellular junctions. Peptide-8 (YTA) was tested by serial dilution and showed an activity that is concentration dependent. Another experiment with previously published peptides was used as a positive control in conjunction with YTA. YTA has been shown to inhibit E-cadherin mediated cell-cell adhesion of Caco-2 and MDCK-2 cell monolayers. There is supporting evidence that YTA might be a more potent alternative to previously published peptides. In the future evaluation of YTA derivatives by point mutation will be tested in the resealing of MDCK cell monolayers.

**Danse Bi**

Application of Hetero-Michael Pathways for the Synthesis of Sultam Libraries

Advisor: Paul Hanson, Chemistry

Three types of sultam scaffolds and libraries have been synthesized using hetero-Michael pathways, including: An 8-member 1,4,5-oxathiazepane 4,4-dioxide sub-library via oxa-Michael reaction (Project A), a 12-member 1,5,2-dithiazepan-1,1-dioxide sub-library through thia-Michael reaction (Project B), and a 1,2,5-thiadiazepane 1,1-dioxide library through a double aza-Michael reaction (Project C). Additionally, the double aza-Michael reaction has been applied on a Chemspeed platform, an automatic synthesizer, as well as Microwave-Assisted Continuous Flow Organic
Synthesis (MACOS) platform for the library synthesis of triazolated 1,2,5-thiadiazepane 1,1-dioxides. The libraries have been submitted to the NIH Molecular Library Small Molecule Repository (MLSMR) for distribution within the Molecular Libraries Screening Centers Network (MLSCN), which will allow for extensive biological screening. An update of this ongoing process will also be reported.

**Jamie Branch**

Tension-Displacement Properties of the Posterior Cruciate Ligament at Maximum Extension Angles
Advisor: Lorin Maletsky, Mechanical Engineering

The purpose of my research is to investigate the tension and displacement properties of the posterior cruciate ligament (PCL) of the knee as it achieves maximum angles of extension. The PCL stabilizes the knee in place, inhibiting excessive hyperextension that could potentially damage the knee during movement or exercise. The femoral and tibial attachment sites of the PCL were recorded by LabView software as they traveled through angles of flexion and extension which were monitored by an Optotrak 3020 infrared camera system. I refined and developed a computer program written in Matlab code to calculate the distance between the femoral and tibial attachment sites which outputs the displacement of the PCL. Plotting these displacement values against the flexion-extension angle shows how the PCL length changes as the knee moves from full flexion to full extension. Adding tension to this plot illustrates a whole new dimension in that it reveals at what stage of flexion-extension the PCL undergoes transverse compression and becomes more taught. To obtain tension data, an integrated pressure transducer (IPT) was inserted in the PCL of a cadaveric knee specimen before kinematic testing was performed. The integration of displacement and tension of the PCL provides insight to anatomical characteristics of this cruciate ligament, as well as explores functional properties of the PCL.

**Sarah Bregman**

Constructing Security on Jeju Island: An Analysis of Elite Rhetoric
Advisor: Professor John Kennedy, Political Science and Global and International Studies

This study analyzed the rhetoric of US and ROK political and military elite to determine the best explanation for the decision to construct the joint US-ROK naval base on Jeju Island. Specifically, the purpose of this study was to determine whether the base is being constructed to ensure regional security. A non-random archival qualitative content analysis was performed on all relevant published information in English between the years 2005 and 2012 on the Jeju naval base in which elite were cited. The World News Connection database, google news, and presidential archives were searched. This study found that elite most frequently cited military security to explain the base’s necessity in ensuring national security; however, elite rarely mentioned from whom the base was intended to protect the ROK. In fact,
evidence suggests that the base is not being constructed to deter future provocations from the DPRK; rather, it is intended to protect against undefined future regional conflicts.

**Allison Brewer**
**Acetic Acid Off-Gassing in Clamshell Enclosures**
**Advisor: Whitney Baker, KU Libraries**

**Introduction:**
This presentation will investigate the use of acid detection strips to study acetic acid off-gassing occurring in custom-made, cloth-covered book boxes constructed and used by conservators in research libraries. Rare book conservators construct custom-fit, cloth-covered containers for special collections material. These “clamshell boxes” are typically constructed with binder’s board and covered with a linen or cotton cloth using polyvinyl acetate (PVA) adhesive. This adhesive off-gasses acetic acid as it cures. Acetic acid is known to cause deterioration of paper and leather, common materials placed in these boxes.

To answer the off-gassing question, Acid-Detection strips (A-D strips) designed by the Image Permanence Institute were tested. The A-D strips consist of a colored strip with a pH indicator that changes color as the levels of acetic acid gas increase.

**Method:**
To test off-gassing potential, sample size components of the clamshell boxes were placed in glass stoppered jars along with an A-D strip. Some adhesives showed an immediate change in acidity. The jars were then left alone but periodically checked at 24, 48, and 72 hours, as well as one, two, and four weeks.

Fifteen partially made clamshell boxes were constructed and aired out for 24 hours prior to being sealed in an inert bag with an A-D strip placed inside each tray. The bagged trays were checked at 24, 48, and 72 hours, and one, two, and four weeks.

**Results:**
The Acid-Detection strips proved effective in detecting acetic acid off-gassing in the enclosures and sample materials. Results from monitoring reveal differences in off-gassing severity among various types of PVA, boards and cloths studied.

**Alahna Broadway**
**Invasive species: introduction methods, impact, control methods**

My poster will show introduction methods, ecological and economic impacts, and control measures of invasive species in the United States. The introduction methods I will focus on are introduction through, the exotic pet trade, biological control, ballast water, and aquarium trade.

**Rachel Brown**
**Assessing Preschool Children’s Knowledge of Complex Nouns from a Logico-Semantic Perspective**
**Advisor: Utako Minai, Linguistics**

Words like ‘teacup’ are called compounds, containing the head noun (e.g., ‘cup’) and the modifier noun (e.g., ‘tea’). Semantically, a compound denotes a subset of its head noun’s
denotation (e.g., ‘teacup’ is a subset of ‘cup’); logically, ‘there’s a teacup’ entails ‘there’s a cup’, but not vice versa. Previous findings conflict on the age at which children successfully comprehend compounds; it thus remains unclear whether/when children understand the logico-semantic relation between a compound and its head noun. My study tested preschoolers’ knowledge of this logico-semantic relation between a compound and its head noun. I utilized the Demand Fulfillment task, a task to assess children’s understanding of the logical relationship between two meanings, and the participants were English-speaking 3- and 4-year-old children. Children saw a story about a ‘demander’ who demands items and a ‘fulfiller’ who tries to retrieve them. The demand is satisfied when the fulfillment statement entails the demand statement (e.g., the demand ‘Bring me a cup’ is logically satisfied by the fulfillment ‘I brought a teacup’, where ‘bringing a teacup’ entails ‘bringing a cup’). Children determined whether the fulfillment was ‘good enough’ to satisfy the demand, thereby evaluating the logico-semantic relation between the compound and its head noun. Though both logically-satisfactory (‘Bring me a cup’ - ‘I brought a teacup’) and logically-unsatisfactory (‘Bring me a teacup’ – ‘I brought a cup’) demand-fulfillments were presented, children overall responded that all demands were satisfactory. These non-adult-like responses will be discussed from a methodological perspective.

Cynthia Brown
College Living Arrangements and Body Dissatisfaction: The Case for Males

Advisor: Ric Steele, Psychology

This study explores the relationship between body dissatisfaction and living arrangements for college males. Though past research has examined social, peer, and media influences related to body dissatisfaction and disordered eating in young adult females, factors associated with male body dissatisfaction are not as well understood. This study focuses on how college living arrangements (e.g. dormitories, fraternity houses) may be associated with behaviors and attitudes which relate to body dissatisfaction; these factors include comparing oneself to peers, beliefs on importance of masculine appearance, and attitudes towards eating. In order to examine these relationships, a questionnaire was administered to male undergraduates (ages 18-23) who live in scholarship halls, fraternity houses, dormitories, and apartments. Statistical analyses were then conducted to compare differences between the groups. Identifying trends in living arrangements that predispose males to higher levels of body dissatisfaction may inform primary interventions or prevention efforts intended to reduce the frequency of maladaptive health behaviors and psychological beliefs for this population.

Samantha Brunker
A Broad-Band Photometric Survey of the Open Cluster NGC 7789
Advisor: Bruce Twarog, Physics and Astronomy

We have used ~200 frames of the open cluster NGC 7789 on the UBVRI system taken with the 0.9m WIYN telescope over four years to survey the cluster and
to define its fundamental properties, in conjunction with a complementary study based on extended Stromgren, intermediate-band CCD data. Removing probable radial-velocity and proper-motion non-members, the color-magnitude diagram (CMD) for the cluster core is extremely well matched by Yale-Yonsei isochrones with an age of 1.5 ± 0.1 Gyr for a derived solar \([\text{Fe/H}]\) and \(E(B-V) = 0.26 \pm 0.02\), as well as an apparent distance modulus of \((m-M) = 12.2 \pm 0.1\). The lower reddening and slightly younger age compared to previous work can be attributed to spatially dependent offsets in the published VI photometry of the cluster. The main sequence approximately one magnitude below the turnoff appears to exhibit a narrow break aligned with the predicted location of the blue edge of the Li-dip among main sequence stars. We gratefully acknowledge support from the National Science Foundation for S.B. as part of the REU program at San Diego State University under grant AST-0850564.

**Rachel Bruursema**

Bio-Acoustical Neuromodulation for Phobia and Excessive Anxiety Reduction Advisor: Nancy Hamilton, Psychology

Recent research on reconsolidation of fearful memories in PTSD sufferers has identified various methods of reducing fear reactivity, including theta pulse stimulation in rat brains found to reverse long-term potentiation. Also, current clinical usage of the Bio-Acoustical Utilization Device (BAUD) suggests acoustical stimulation can reduce anxiety in clinical populations. The aim of this study was to investigate whether acoustical theta stimulation in human subjects with specific animal phobias could reduce fear reactivity to the exposure of photos of phobic stimuli as measured by heart rate (BPM), electrodermal response (EDR) and self-reported fear, anxiety, and stress. Sixty college undergraduates are participating. Participants are qualified for participation by scoring in the moderate range on respective screening questionnaires: Spider Phobia Questionnaire (SPQ), Snake Questionnaire (SNAQ), and Dog Phobia Questionnaire (DPQ). Those invited to participate are measured for BPM and EDR. After baseline measurements, participants are exposed to a sixty-second sequence of photos of their phobic symbol. They are then administered one of three BAUD conditions; a theta frequency of 5 Hz, a beta frequency of 22 Hz, or a white noise “sham” condition. After a two-minute rest period, they are then exposed to phobic photos again. Participants rate their emotions after each picture exposure. The theta frequency condition is hypothesized to be most effective in reducing BPM, EDR and self-rated fear, anxiety and stress during the second picture exposure.

**Rachel Bruursema**

Bio-Acoustical Neuromodulation for Fear and Excessive Anxiety Reduction Advisor: Evangelia Chrysikou, Psychology

Recent research on reconsolidating of fearful memories in PTSD sufferers has identified various methods of reducing fear reactivity, including theta pulse stimulation in rat brains found to
reverse long-term potentiation. The aim of this study was to investigate whether acoustical stimulation in human subjects could assuage fear reactivity to the recall of fearful memories as measured by heart rate (BPM), electrodermal response (EDR) and self-reported fear, anxiety, and stress. Twenty-one college undergraduates participated. After baseline measurements, participants were asked to think of their most fear-provoking scenario while being administered one of three Bio-Acoustical Utilization Device (BAUD) conditions; a pre-set theta frequency, a frequency of their own choosing, or a white noise “sham” condition. Post-intervention interviews were conducted intending to provoke arousal of the putative fear in the subjects while measurements were undertaken for comparison between groups. Results found promising trends for the set theta condition, producing the lowest physiological reactivity after intervention and greatest decrease in self-report measurements. Although no statistical significance was present, preliminary evidence was supportive of the hypotheses. Implications suggest future research on effects of acoustical stimulation in a theta frequency for phobic populations.

Michael Burch
The Studio Pod: An Architectural Investigation of a Live/Work/Study Cubicle
Advisor: Kapila Silva, Architecture

This Poster Presentation explains the Studio Pod; a system designed to optimize functionality, comfort, and efficiency of the typical working desk in an architectural or design studio. It is a pre-fabricated set of recycled plastic components that are assembled by the client, creating a modular, stackable pod replacing the common desk. The objective is to turn the studio desk into a livable space that becomes a secondary home for the user; including a bed for sleeping, ample storage room, areas for personalization, and to operate in the cleanest, easiest way possible. The Pod splits the single working surface into two, one on either side of a moveable seat that operates on a frictionless track. One of the surfaces is intended for an electronic work surface (desktop or laptop), and the other is for hand work (models, sketching, and hand drawings). The chair of the pod is the anchor of the project, as it is designed to become the sleeping surface. Other design aspects include an exterior display shelf for drawings and models, climbing ladder with a retractable handrail, sliding transparent shading devices, interior lighting, exposed shelving, tool and material organizers, and ample interior storage and pinup space. The Pod also acts as a system of pods that become a community for the studio that saves space, provides a compelling, futuristic aesthetic value to the studio, and ultimately creates a secondary living environment for students that spend more time in their workspace than at their homes.

Mugabi Byenkya
E-waste: A necessary means to an end?
Advisor: Byron Caminero-Santangelo, English & Environmental Studies
Electronic waste, also known as e-waste is discarded electronic devices such as mobile phones, televisions, computers etc. Rapid changes in technologies along with planned and perceived obsolescence (the deliberate use of inferior inputs in the production of a product to ensure higher profits through the purchase of a replacement or an ‘upgrade’) results in a quick-growing surplus of e-waste across the world. In an effort to mitigate this, the UNEP created the Basel convention of 1992, which “is an international agreement intended to minimize the creation of hazardous waste in both quantity and hazardous quality, to reduce the trans-boundary movement of hazardous wastes, and to encourage the disposal of such wastes as close to their source as possible” (Environmental Politics: Scale and Power; O’Lear, pg.124). However, due to several loopholes it is only valid for 35 countries that have signed and ratified it. Thus, the developing world remains stuck and exploited by the status quo that appears as if it is an equitable arrangement. The scale and framing of e-waste (particularly in Ghana and Nigeria) parallels the oil extraction in the Niger Delta particularly through the negative environmental and societal effects on the local community and the inequalities in the ways that globalization affects the African continent through the entrenchment of the capitalistic global economy.

Henry Clever
Imaging Thin Films of Non-Newtonian Fluids
Advisor: Sarah L. Kieweg, Mechanical Engineering

Thin film flow is of interest in many fields, such as industry paints, contact lenses, microchip fabrication, nature (lava flow and glacier flow), and biomedical applications (anti-HIV microbicides). Although the behavior of Newtonian fluids such as water and oil have been studied extensively, non-Newtonian fluids such as hydroxyethyl celluloses (HEC) differ because of shear-thinning properties. Many authors have used an imaging system with fluorescent dye to image Newtonian fluids as they flow down a slope. Previous authors have illuminated the fluid at a wavelength which excites the dye and captured an image of the light emitted by the dye. Beginning with previously published experimental methods, this project’s goal is to expand these methods in finding the optimal way to measure non-Newtonian fluid depth (order of mm) over a large surface area (up to 40 x 60 cm). Like previous techniques, it will save significant costs to substitute LEDs for lasers as a form of illumination. The preliminary images captured show fluid depth as a function of light intensity and can be used to determine flow behavior. The relation of light intensity as a function of fluid depth is already known; once the variables are found an accurate model can be made. By performing an in-depth analysis of non-Newtonian fluid flow, a better vehicle can be selected to transport microbicides and increase effectiveness. Furthermore, the findings of this experiment can be applied to many other research fields such as biology, chemistry and engineering.
Kimberly Cole  
Rotary Task Moment Analysis of the Lower Extremity after Total Knee Arthroplasty  
Advisor: Lorin Maletsky, Mechanical Engineering

The purpose of this research is to compare the vertical component of a healthy individual’s knee moment while rotating and leaning onto the knee with the knee moments of those who have received a total knee arthroplasty (TKA). Lower extremity rotations involving height are a part of everyday tasks such as lifting items and reaching high shelves. Studying the effects of a TKA to this task would add to the literature of knee replacement characteristics and provide a basis of data for future research to improve the quality of life of TKA recipients.

To record the data, subjects stood on force plates and performed a “crossover” task by moving sagittally and transversely at the same time to push a button that marked the start and stop times of their task. Twenty-three subjects participated; twelve healthy subjects were the controls, and five left and six right TKA recipients also contributed.

Graphs of lower extremity rotation over time suggest that the task durations of the subjects with a replaced knee were longer than the controls’. Further analysis is in its preliminary stages. Data from two subjects were disregarded due to calibration errors.

Future experimental improvements can include testing more subjects, calibrating force plates and buttons more often, and noting the dates of arthroplasty. Individuals who underwent TKA may have adapted to his or her replaced knee individually and modified their posture accordingly, suggesting that patients would benefit from personalized care.

Ian Cook  
Vishuddha

The writers and musicians of the Beat generation walked the line between songs and poetry with musical accompaniment. They understood the malleability of sound and how it can strike deep into our center. In my creative endeavors I hope to find the connections and disconnects between the two genres. How do they complement each other? Does different placement of emphasis or pause affect the performance positively or negatively? Does the inclusion of music hamper the delivery and understanding of the work? Utilizing existing forms in tandem to pursue new creative endeavors could yield unexpected and wonderful results. Through constructing and then performing my pieces in a public forum, I hope to gauge the effectiveness of my performances. I also want to explore the process of creating new pieces based on existing work. How does writing words to fit music differ from composing the accompaniment for a poem? Are there different emotional payloads for the audience depending on the process of creation? I want to unearth the wild and wonderful possibilities held within unexplored creative endeavors. I want to expose the public to the possibilities of working across genres so that they too may explore. I will be writing a series of poems based on music I have written, as
well as writing music to accompany poems I have previously written. My project will explore the relationship between poetry and music in performance. For performance I will be playing guitar and reading poetry simultaneously.

**Jenny Curatola**
Performing Paley
Advisors: Cheryl Lester, English & American Studies and Leslie Bennett, Theatre

Eighty is the new sixty-five, given the sudden extension of the life span in American with the dawn of modern medicine and technology, but our current cultural script does not address how we will play out those extra decades. To age successfully, we must adapt the life script to fit our new conditions. Theatre provides a critical and engaging space for influencing public opinion, but it can also function as its own research process to test different modes of being on the “laboratory of life” commonly known as the stage. Drawing on deconstructive theory, age theory, and various theatrical techniques (namely epic, interactive, and devised), I adapted Grace Paley’s short stories on aging and led an ensemble of student actors through a collaborative effort to gather information from the community and their own life experiences to create an original full-length performance that both explores current perceptions of aging and proposes positive alternatives. This process, which ultimately resulted in a February production titled "One Wild and Precious Life", brought two distant generations together, gave voice to marginalized elderly members of the community, and prompted open discussion about rewriting the “decline narrative” that tells us life only gets worse as we age. By combining community outreach and personal reflection with traditional rehearsal, I achieved a mode of creating and a style of performance that goes beyond aesthetics and entertainment and becomes a form of activism and community development.

**Tyler Darland**
The Role of Mical within the UNC-6/Netrin signaling pathway
Advisor: Erik Lundquist, Molecular Biosciences

The nervous system consists of specialized cells called neurons. Each neuron has an axon that is responsible for sending information to other neurons. During nervous system development, axons are guided to target locations by a structure called a growth cone. The growth cone responds to extracellular cues that change the actin cytoskeleton within the growth cone, resulting in attraction or repulsion to specific stimuli. To study axon guidance, we utilize the model organism *Caenorhabditis elegans* and green fluorescent protein (GFP) to view specific neurons. One extracellular cue that can trigger either attraction or repulsion is UNC-6/Netrin. We focus on the repulsive pathway of UNC-6/Netrin, which triggers remodeling of the actin cytoskeleton to cause localized growth cone collapse after the binding of UNC-6/Netrin to the receptor proteins UNC-
40/DCC and UNC-5. In other animals, proteins known as Mical regulate axon guidance by disassembling the actin cytoskeleton. My results suggest that Mical proteins control axon guidance in *C. elegans*. Because both repulsive Netrin signaling and Mical proteins cause growth cone collapse, I next asked whether the Mical proteins are components of the repulsive UNC-6/Netrin pathway. To do this, I built strains of *C. elegans* that lack specific Mical genes and have constitutively active Netrin receptors to test whether the removal of Mical genes results in the short circuiting of this signaling pathway. I used growth cone analysis to observe the developing axons in mutant worms and compared them to wildtype (normal) worms. Results of these experiments will be presented at the symposium.

**Joshua Dean**

Identifying Factors Affecting Student Transition from Primary to Secondary Education in Selected Developing Countries

Advisor: Elizabeth Asiedu, Economics

The percentage of pupils in Sub-Saharan Africa who successfully transition from primary (ISCED 1) to lower secondary (ISCED 2) education ranges from 36% in Tanzania to 98% in Seychelles. Beyond the range of transition rates, there is enormous variation in how much each country has improved in the last ten years. This paper examines the wide variation in transition rates as calculated by the United Nations Educational, Scientific and Cultural Organization’s Institute for Statistics (UIS) from 1999-2010 in selected developing countries. The educational and economic policies of four countries that have shown significant improvement (Senegal, Uganda, Niger and Gambia) are compared to those in two countries who have not improved (Ghana and Morocco). Analysis using fixed effects regression finds several variables of interest. A model is then developed to explain the observed effects.

**Rena Detrixhe**

Bring to the Table

Advisor: Cima Katz, Visual Art

I am a hunter and gatherer of materials. Thus, many works begin with objects or elements I collect. I use these materials to create drawings, sculptures, and site-specific installations that combine multiplicity and repetitive process. By inviting a conversation between material and process I am often guided by the very nature of the material. I see relationships with my own process and those of traditional crafts such as crocheting and embroidery and I have begun integrating them into my recent work. These activities involve intense focus and repetitive and meditative qualities that parallel the way I work with material. I am also interested in how the crafted object becomes a relic of personal sentiment and gesture. By combining these actions with objects collected from nature or everyday life I hope to form a bond between place and person; between the hand of nature and the hand of the individual.

I am always searching for juxtapositions inherent in nature that relate to the human condition: permanence and
impermanence, comfort and discomfort, fragility and strength, past and present. By exploring these sentiments and my own connection to the land and to place, I hope to form a connection between the outer and inner landscape. By working with place as both material and content the work becomes more than just a physical representation; it becomes an experience, an emotion.

Corinne Edds
Intracellular Calcium Level Changes in Cultured Neurons Through Live Cell Calcium Imaging In Response to Thromboxane A2
Advisor: James Orr, Molecular Biosciences

Previous work in this lab has shown that sensory neurons contain mRNA transcripts for the thromboxane A2 receptor (TP) and could play a role in sensory responses to pain and inflammation. We hypothesized that treatment of cultured neurons with a mimetic of thromboxane A2 (U-46619) would lead to an increase in intracellular calcium levels. Dorsal root ganglia were excised from euthanized rabbits, cultured and incubated overnight. Cells were pre-treated with the calcium indicator dye Fluo-4 (AM) and imaged on a Spinning Disk Confocal Inverted Microscope. A dose response of U-46619 (0.5uM, 4.5uM, 45uM) was performed and fluorescence measured. Following treatment with U-46619, cells were exposed to 120mM KCl, a strong depolarizing agent, to confirm that they were still viable and responsive. Data from the increasing dosages of U-46619 indicated modest but measurable responses; (12% increase in fluorescence after addition of 0.5uM U-46619 (n=10 cells), 6% after treatment of 5uM U-46619 (n=10 cells), and 10% following treatment of 50uM U-46619 (n=11 cells)). The addition of 120mM KCl led to a 17% increase in fluorescence (n=10 cells). In summary, the data support the hypothesis that U-46619 elevates intracellular calcium levels in cultured sensory neurons. However, the responses to U-46619 did not follow a typical dose response pattern. Although additional data are needed to confirm this observation, the current data suggest that these cells may develop a rapid tolerance to increased doses of the drug U-46619.

Mallory Eddy
Depression and Coping Mechanisms
Advisor: Rick Ingram, Psychology

Depression affects 1 in 10 Americans (Centers for Disease Control). Research has long shown that women are more susceptible to depression then males. One possible explanation for this difference is the different coping styles of male and women. We hypothesized that the persons gendered mattered less in regard to their coping style then did their high masculinity and/or low femininity. People with high masculinity and/or low femininity coping mechanism have lower rates of depression. Participants were given a series of tests to determine their masculinity/ femininity and coping styles. Then, part of the sample under went a negative mood induction while the other portion received a neutral mood tape. After the tape participants were again give questionnaires about
mood and coping styles. The results showed that people who had high musicality scores were less likely to have negative coping styles.

Katherine Evans
How word-frequency influences word-learning
Advisor: Michael Vitevitch, Psychology

Previous studies on word-learning found that participants learn new words that sound like many known-words more quickly than new words that sound like few known-words (Storkel, Ambruster & Hogan, 2010). For example, “fub” sounds like chub, cub, rub, fib, fudge, and many other words, whereas “koize” sounds like noise, coil, and a few other words, making “fub” easier to learn than “koize.” In the present study we asked participants to learn new words that had just one similar word (e.g., frepple sounds like freckle, but no other words in English), but the known word was either high or low in the frequency with which it occurs in English. Participants were trained in several sessions on 10 new words paired-up with novel objects. Immediately after each of 3 training sessions, participants were presented with a picture of the novel object and asked to name it. By the final testing session we found that novel words that were similar to a high frequency word were learned better than novel words that were similar to a low frequency word. This is important because know we have an understanding as to why some words are easier to learn than others.

Bonnie Ewart-Fisher
Sexuality in Early Modern Japanese Society Through the Works of Saikaku
Advisor: Maggie Childs, East Asian Languages and Cultures

In spite of his status as an important figure in the realm of Japanese literature, little research exists that expounds upon the sexual roles presented in Saikaku’s literature. Through the lenses of early modern Japanese satirist Ihara Saikaku’s works, a distinct picture of Tokugawa era sexuality emerges. Within the narrow framework of Tokugawa female sexuality, women of the pleasure district within Saikaku's novels "The Life of an Amorous Man" and "The Life of an Amorous Woman" have the ability to utilize their sexuality in order to gain social status and move up in the ranks of the pleasure districts. Alternatively, men within these texts do not have this ability to utilize the pleasure district for social mobility, but rather are able to use the women of the pleasure district as indicators of their social status. From the point of view of social status, women in Saikaku’s "The Life of an Amorous Man" and "The Life of an Amorous Woman" are able to make the most of the few sexual roles available to them while men’s relationship to the pleasure district, while not static, is one of reflection. These satirical works reflect the complex nature of sexuality within Tokugawa society and the analysis of these 2 novels elucidates the world of early Japanese sexuality while also exploring the few means of social mobility available to women of Tokugawa era Japan.
Christopher Farley  
Unit Cohesion: The Undiscussed Contributor to the My Lai Massacre  
Advisor: Adrian Lewis, History  

In March of 1968, a group of American soldiers descended upon the Vietnamese village of Son My under the impression they were to meet the enemy in direct combat for the first time. Upon their arrival in the My Lai hamlet, the men found only Vietnamese noncombatants. Despite the innocence of the civilians, the American soldiers of Charlie Company began a massacre. The incident in My Lai, often referred to as the worst atrocity in United States Military history, showed a groupthink mentality shared by the contributing soldiers. The United States Army Criminal Investigation Command (USACIDC) interviewed every soldier involved in some way with the My Lai Massacre. Those testimonies were used in an attempt to prove that, while inept leadership, racism, and vengeance are accepted as the causes behind the massacre, unit cohesion is the overarching contributor. This oral presentation will explain the concept of unit cohesion and how it enabled the massacre in the My Lai hamlet of Son My.

Brad Fasbinder  
Bio-Acoustical Neuromodulation for Fear and Excessive Anxiety Reduction  
Advisor: Evangelia Chrysikou, Psychology  

Recent research on reconsolidating of fearful memories in PTSD sufferers has identified various methods of reducing fear reactivity, including theta pulse stimulation in rat brains found to reverse long-term potentiation. The aim of this study was to investigate whether acoustical stimulation in human subjects could assuage fear reactivity to the recall of fearful memories as measured by heart rate (BPM), electrodermal response (EDR) and self-reported fear, anxiety, and stress. Twenty-one college undergraduates participated. After baseline measurements, participants were asked to think of their most fear-provoking scenario while being administered one of three Bio-Acoustical Utilization Device (BAUD) conditions; a pre-set theta frequency, a frequency of their own choosing, or a white noise “sham” condition. Post-intervention interviews were conducted intending to provoke arousal of the putative fear in the subjects while measurements were undertaken for comparison between groups. Results found promising trends for the set theta condition, producing the lowest physiological reactivity after intervention and greatest decrease in self-report measurements. Although no statistical significance was present, preliminary evidence was supportive of the hypotheses. Implications suggest future research on effects of acoustical stimulation in a theta frequency for phobic populations.

Marcus Florez  
Analysis of Mitochondrial Haplotypes, APOE and TOMM40 Genotype with Alzheimer’s Disease  
Advisor: Elias Michaelis, Pharmacology and Toxicology  

Mitochondrial dysfunction and decline is well known to be a prominent event
in the development of Alzheimer’s disease (AD). It has also been strongly suggested that both nuclear and mtDNA variation contribute to mitochondrial dysfunction and AD pathology. Inheritance of the nuclear DNA variant of APOE, the APOE e4, has been known to be a leading risk factor in AD. The TOMM40 gene, also located on chromosome 19, has been recently associated with AD. Cybrid evidence strongly suggests a role for mt genes in the development of AD. However, previous studies that have investigated mtDNA variation and the risk of AD have gotten mixed results. The objective of this study is to examine the TOMM40, APOE, and haplogroup status of AD and non-AD patients in order to gain a better understanding of the genetic factors that influence AD pathology. This seems to be the first study to assess the TOMM40, APOE, and haplogroup status in association with developing AD. Thus far primer/probe sets were developed to genotype 8 single nucleotide polymorphisms that distinguishes nine common European haplotypes. Using Real-Time PCR, the haplogroup of 218 DNA samples from AD and non-AD patients were determined. The haplotype data will be combined with genotyping data for APOE and TOMM40 and statistical analysis will soon be used to assess the risk of AD, severity of AD, and age of onset of AD with respect to haplogroup status, sex, and APOE and TOMM40 genotype.

Alexander Fondaw
Identifying Inhibitors of ZipA Through Computational and Biochemical Screening

Advisor: John Karanicolas, Bioinformatics

Many formerly treatable bacterial infections are becoming harder to cure because widespread overuse of antibiotics has led to the development of antibiotic resistant strains. The aim of my project is to find a new antibiotic that will disable bacteria by a different mechanism than current antibiotics. A new possible pathway to inhibit bacterial growth is by interrupting the interaction of two proteins involved in cell division, ZipA and FtsZ. The interaction between ZipA and FtsZ is found in the vast majority of bacteria so interfering with it with a small molecule should be effective for many different bacterial strains. The mechanism is that first, multiple FtsZ proteins creates a loop of incomplete cytoskeletal filaments which are called the Z-ring. The Z-ring spans the equator of the cell just underneath the cytoplasmic membrane. During cell division, ZipA binds to FtsZ which causes the filaments to connect and a solid loop to form across the middle of the bacterial cell. This loop then shrinks at the end of cell division, causing the telekinesis of the cell into two distinct cells, thus reproducing more bacteria. Without ZipA, the fragments do not connect or condense to divide the bacteria. An effective antibiotic would inhibit the interaction in between ZipA and FtsZ. A small molecule would be put in the binding site on FtsZ, hindering the ability of the ZipA to bind. The small molecule would outcompete the ZipA and effectively stop cell division in the bacteria.
Garrett Fugate  
The Creation of Sacred Islamic Spaces out of non-Islamic Buildings  
Advisor: Kapila Silva, Architecture

I came into maturity as a Muslim in a community that worshipped in a former church and it has always felt like a spiritual and communal home to me. My architecture research into mosques like my own has allowed me to delve deeper into what makes these spaces appropriate for the American Muslim faith community. What changes, visible and invisible, do these buildings undergo? What do those changes say about their respective communities? In my research, I hypothesized that buildings transformed into places of Islamic prayer and community have a vernacular intuitiveness to the general needs of its congregants. According to Amos Rapoport, sacred vernacular spaces are a “direct physical embodiment of a way of worship and of a community, in the same way that vernacular houses are the physical embodiment of a way of life” (Rapoport, Amos. “Sacred Space in Primitive and Vernacular Architecture.”) Through interviews of Muslims deeply involved in their respective faith communities in Kansas and Missouri, I hoped to shed light on this “vernacular intuitiveness” of converted mosques. At its core, this intuitiveness of space creation addresses the need for human connection with God and the need for human connection with other people. Buildings repurposed as mosques are built from the inside out. They are about relationships, not domes and minarets. My research is about understanding this intersection of community, belief, and place.

Erin Fulton  
Secular Repertoire in American Dispersed-Harmonic and Reform Tunebooks, 1820-1850  
Advisor: Paul Laird, Music

The majority of pieces in early American tunebooks set sacred texts. Despite their scarcity, however, secular songs held a distinctive role in tune-book repertoire and can offer a perspective on the more fundamental issue of competing styles of part-writing. In early-nineteenth-century American hymnody, two styles of part-writing dominated: dispersed-harmonic and reform. This examination of twenty-seven tunebooks from the Carl N. and Dorothy H. Shull Collection of Hymnals and Music Books at Spencer Research Library reveals differences in reform and dispersed-harmonic music specific to the secular repertoire, while further clarifying the basic distinctions between the two. Although secular texts tend to fall within a small spectrum of topics, some subjects are specific to dispersed-harmonic or reform collections; for instance, nature songs appear exclusively in reform tunebooks, while parting songs are unique to the dispersed-harmonic repertoire. These differences in subject suggest that secular pieces may have been sung in different performance contexts within the dispersed-harmonic and reform milieus. This theory is supported by the dissimilarity of secular music in reform tunebooks and reform textbooks. The occasional “Christianization” of originally secular pieces within dispersed-harmonic tunebooks reveals a
fluidity of genre that apparently did not exist in the reform repertoire. Finally, the curious case of “Hinton New” in Charles Zeuner’s Ancient Lyre (1837) suggests that the musical differences between sacred repertoire in the dispersed-harmonic and reform traditions may have had ideological as well as aesthetic bases. These unusual pieces offer a glimpse into a side of tunebook culture that is presently given little attention.

Jennifer Geller
Bejeweled Bones: Examining shrines and the holy dead in the Medieval Christian tradition
Advisor: Kathryn Gerry, History of Art

Human beings are the only species to bury their dead. We have an irresistible attachment to physical remains that has manifested itself throughout history and been the catalyst for some of humanity’s strongest convictions. The visual components of a medieval saint’s shrine, including the tomb, altar, and altar adornments, have much to say about the theology of medieval Christianity and its relationship with the holy dead. The medieval shrine functioned as a visual locus of esoteric transformation; the underground tomb contained a palpable power, distributed to pilgrims through the conduit of the altar. This miraculous benefaction, centered around the physical body, parallels the miraculous transubstantiation of the Eucharist which occurs at the altar. I am examining the treatment of sacred bodies in the medieval Christian tradition and the monuments and liturgical practices that they inspired.

The striking aesthetics of the altar and tomb spaces do much in the way of education and inspiration; these monuments remain a rich visual testament to the eternality of faith.

Robert Healey
Lightweight Amplifiers for Acoustic Measurement and Electro-Acoustic systems
Advisor: Bob Coffeen, Architecture

Audio amplifiers designed for use in acoustic measurement and professional sound reinforcement traditionally have been heavy, large, and expensive. Recently, a new method of designing audio amplifiers has cut down weight, increased efficiency, and lowered cost. The acoustical consulting industry, however, has not rushed to adopt this new technology out of a fear that it does not perform as well as older methods. This project is designed to test the new type of lightweight amplifier and scientifically determine whether they are suitable for acoustical measurements and electro-acoustic systems.

Sophia Hilleary
Designing for an Unstructured Play Experience
Advisor: Richard Branham, Design

The study of play and its importance developmentally is an emerging field that is receiving an ever-growing amount of attention in recent years, as play has become more commercialized and as parents have become more risk-averse. To many researchers, these changes represent threats to unstructured play, a type of play that is
spontaneous, free form, and unrestricted by an established set of rules. For both children and adults, unstructured play creates opportunities for problem solving, cooperation, experimentation, and the forming of healthy relationships. Traditional playgrounds are static, hard, cold, sterile, not environmentally sustainable, and not age-inclusive. My design is a universal, portable play solution that is made of soft materials, is environmentally friendly, and is inexpensive to produce. This “pop-up” play space can be manipulated to create an infinite number of play structures, which encourages people of all ages to play while using skills like creativity, problem solving, and cooperation.

Benjamin Hofmeier
Vernier Reaction Control System
Reboost Translational Maneuver of the Hubble Space Telescope During STS-82
Advisor: Steven Hawley, Physics & Astronomy

Many different Space Shuttle missions have been solely devoted to the launch and maintenance of the Hubble Space Telescope (HST). Throughout these missions, the scientific capabilities of the telescope have been improved, the orbit has been rebooted, and the lifetime has been increased. Without these missions, the HST could not have had near a successful life. One mission is of particular interest for this paper. Space Transportation System 1 (STS-1) was the second maintenance mission for the HST (SM-2). Upon inspection of the solar arrays (SA’s) in missions leading up to STS-82, it was determined that a reboost using the Primary Reaction Control System (PRCS) would not be structurally feasible. It was thought that a reboost involving the PRCS would put too much stress on the already bent solar arrays. Two other maneuvers were developed through STS-78 and STS-79 which involved pitching and yawing in respectively. The Vernier Reaction Control System (VRCS) would be used for this mission due to its lower thrust capabilities. This report details the development, execution, and aftermath of the VRCS yaw maneuver from STS-82. This had significant effect both on that mission, the HST, and on the International Space Station (ISS).

Andrew Jamison
An ERP Study of Number Prediction in Noun Phrases
Advisor: Ruth Ann Atchley, Psychology and Robert Fiorentino, Linguistics

Agreement is an important syntactic property of many languages throughout the world, and the realm of agreement is a fruitful testing ground for cognitive models of sentence parsing. Past work using electroencephalography (EEG) to investigate morphosyntactic agreement processing has identified a biphasic event-related potential (ERP) pattern of the left anterior negativity (LAN) followed by the P600 resulting from agreement violations (e.g. “The girls is jumping.”, “The dogs barks.”). The processes leading up to the critical word and which generate expectations about the word’s inflectional morphology have been less well studied, however. In the case of English, number feature information of a noun may be signified by a preceding determiner in the same phrase. The demonstrative determiners
this and these constrain the noun to being singular or plural, respectively, whereas the non-demonstrative determiner the is ambiguous. This study used 30-channel EEG and visual word-by-word presentation to investigate the time-course of number processing in a noun phrase beginning at a determiner and ending 1000 msecs following onset of the noun. Findings are discussed in the context of previous theoretical and experimental work.

Elizabeth Jarvis
Lethal phase and phenotypic analyses of a collection of prepupal lethal mutations in *Drosophila melanogaster*
Advisor: Robert Ward, Molecular Biosciences

The steroid hormone ecdysone regulates all the major developmental transitions during the life cycle of *Drosophila melanogaster*. An important transition occurs during metamorphosis, in which larval tissues are destroyed and adult tissues, derived from imaginal discs, undergo morphogenesis to form the adult body plan. As metamorphosis in *Drosophila* is hormonally controlled, it serves as an excellent paradigm to study hormonally regulated developmental processes in higher organisms. To identify how ecdysone regulates aspects of metamorphosis, we examined *Drosophila* mutations that resulted in prepupal lethality. We obtained 71 prepupal lethal mutations from a genetic screen preformed by Wang et al. (2008; Genetics 180:269). As a class project in Biology 418: Advanced Laboratory in Fly Genetics, we characterized the lethal phase and terminal phenotypes of these mutations. For the lethal phase analysis, we collected 30 to 50 mutant late larvae for each line and determined how many of them pupariated over a three-day period. We also characterized the terminal phenotypes of the dead larvae and prepupae for each line. Additionally, we examined imaginal disc morphogenesis during metamorphosis. For these experiments we dissected leg and wing imaginal discs from wild type and mutant larvae and prepupae and photographed these tissues on a compound microscope. Ultimately, we plan to identify the gene affected by these mutations by a combination of meiotic mapping, complementation analysis and genomic sequencing. By studying ecdysone’s regulation of morphogenesis in *Drosophila*, this research provides important insights into similar hormonally controlled developmental processes in higher organisms.

Joseph Kellum
Cooperation of L-Type and Cyclic Nucleotide-Gated Ca²⁺ Channels in Prolonging U-46619-Induced Vascular Contraction
Advisor: James Orr, Molecular Biosciences

Previous experiments have demonstrated that the rate of relaxation of vessels treated with the thromboxane-A2 mimetic, U-46619, is lower than those treated with other vasoactive agents. As a means of investigating the molecular mechanisms for this difference, we examined the roles of two types of calcium channels. L-type Ca²⁺ channels have long been associated with the U-46619
contraction, while cyclic nucleotide-gated (CNG) Ca\(^{2+}\) channels have only recently been shown to be involved. We tested the hypothesis that functioning of both channel subsets is necessary to prolong the U-46619 contraction. An organ bath setup was used to measure the rates of relaxation (g/min) in aortic vessel segments obtained from euthanized rabbits. Isolated vessels contracted with U-46619 were treated with various combinations of L-type channel inhibitor (nifedipine, 200 μM) and CNG channel inhibitor (L-cis-dilitiazem, 140 μM). Mean relaxation rates were obtained for four treatment groups: nifedipine only (0.0763 g/min, n=4), L-cis-dilitiazem only (0.0597 g/min, n=5), both inhibitors (0.0693 g/min, n=8), and vehicles only (0.0331 g/min, n=4). Statistical analysis of the data indicated that the mean relaxation rate for the vehicle-treated group differed significantly from the relaxation rates of the experimental groups (P=0.012), which were deemed statistically synonymous (P=0.557). These data indicate inhibition of one calcium channel, regardless of identity, is equivalent to inhibiting both channels with relation to effects on relaxation rate. This demonstrates that optimal functioning of both channel subsets is necessary for the prolonged contraction, characteristic of U-46619-treated vessels. Moreover, these results allude to an interdependent relationship between the two subsets of calcium channels.

**Daniel Kennedy**
Design and Deployment of the Askaryan Radio Array South Pole Autonomous Renewable Power Stations

Advisor: Dave Besson, Physics and Astronomy

Research was initiated in 2009 to determine the feasibility of constructing 300W autonomous renewable energy power stations at the South Pole. In January 2011, a test power station was constructed at the South Pole using three small scale wind turbines that included a system health monitor, meteorology and power instruments and remote communications pipeline. Significant testing and development was performed to prepare the hardware and electronics for the sub -40C environment. During December 2011, additional wind turbines and equipment were deployed at the South Pole to upgrade existing systems and perform additional testing. Results of field testing are presented.

**Kirsten King**
Impacts of Teleconnection Patterns on Relative Spatial Distribution of Spring Tornadoes in the Contiguous U.S.

Advisor: Johannes Feddema, Geography

The United States is influenced by several teleconnections, which are known particularly for their impact on coastal weather. For this project, the Arctic Oscillation, North Atlantic Oscillation, El Nino – Southern Oscillation, and Pacific Decadal Oscillation were analyzed to determine what, if any, impact they have on the relative spatial distribution of tornadoes across the contiguous U.S. from March through June. Tornado occurrence is often associated with jet stream location. For example, during El Nino years, the jet stream
shifts relative to La Nina years, consequently there should be spatial correlations between ENSO and tornado patterns across the U.S. Based on this, it can be hypothesized that shifts in the jet stream due to teleconnections will impact relative tornado spatial distribution during spring months. Tornado data was collected from 1950 through 2011, and includes tornado frequency and locations. To identify changes in relative occurrences of tornadoes and number of tornado days, the U.S. was divided into eight regions. To account for lack of data from earlier decades, relative measures of frequency by region were used. The proportion of tornado days and tornado counts by region were analyzed for temporal trends. Relative tornado statistics were compared to the respective indexes for each teleconnection over the observation period, and to account for lag correlations by comparing six months and annual periods prior to March of the observation period. Results show that tornado frequency was highly variable but there was no consistent nationwide temporal trend, although there were strong correlations in the western regions.

Robert Knight
Delay Circuit for Doppler Shift Simulation
Advisor: Christopher Allen, Electrical Engineering and Computer Science

In order to test the Digital Signal Processor (DSP) being designed for Dr. Allen's UAV RADAR project, I developed a board to allow us to simulate a Doppler shifting signal. A delay chip (Maxim DS1023) is controlled using an Arduino in order to impose a variable delay on a function generator signal. This system allows the exact parameters of the Doppler shift to be altered at will. Matlab is used to evaluate the output signal and determine that it is an accurate approximation of a Doppler shifting signal.

Jordan Koch
Algorithms for Calculating Pattern Class Probabilities on Phylogenetic Trees
Advisor: Mark Holder, Ecology and Evolutionary Biology

A wide variety of evolutionary analyses are based upon the pairing of phylogenetic trees with models of how biological traits change during evolution. In some contexts, one needs to calculate the probability that any member of a class of patterns will arise on the tree. For example, the model adequacy approach of Waddell et al. (2009) requires calculating the probability of several classes of patterns. In order to extend Lewis’s morphological models to deal with many data sets, calculating the probability of any parsimony-informative pattern arising is required (‘parsimony’ referring to the simplest explanation of the data, and ‘parsimony-informative’ referring to those patterns which affect phylogenetic estimation).

We recently developed an algorithm that includes a general approach applicable to any standard model of character evolution, which was published in a peer-reviewed journal article online. We validated our data against Waddell’s simulations, and
performed run-time checks to ensure accuracy.

Now, we are working to develop efficient, dynamic programming algorithms, which calculate the probabilities of pattern classes in one pass down a phylogenetic tree. Focusing on parsimony-uninformative patterns, that is, optimizations for the fully symmetric models, we are now implementing these algorithms in open-source software written in C++ and plan to include the approaches in the GARLI software package for use in inferring evolutionary trees.

Alex Kong
Evaluating the mechanism of \(\alpha\)-tocopherol-mediated recovery of lysosomal impairments in neurodegenerative diseases
Advisor: Jeff Krise, Pharmaceutical Chemistry

Neurodegenerative diseases including Alzheimer’s, Parkinson’s, and Niemann-Pick disease demonstrate characteristics of lysosomal dysfunction. Under these diseased conditions, lysosomal trafficking and catabolic activity are thought to be impaired, leading to lysosomal aggregation, lysosomal volume expansion, and a severe perturbation of normal homeostatic balance. Cationic amphiphilic drugs (CADs) are weakly basic drugs that are substrates for ion trapping, resulting in massive drug accumulation within lysosomes and emulation of the diseased cells’ lysosomal impairments. Previously, researchers have shown that \(\alpha\)-tocopherol can mitigate lysosomal impairments in both diseased cells and cells impaired by drug treatment, though the mechanism by which it achieves these changes is debated. We have sought to characterize this mechanism by using both a drug-induced and neurodegenerative disease model. Based on previous findings, we hypothesized that \(\alpha\)-tocopherol recovers lysosomal function by improving impaired lysosomal vesicle-mediated trafficking and reducing the aqueous volume of lysosomes. To support this hypothesis, we are investigating multiple variables that could result in the observed effects of \(\alpha\)-tocopherol including alterations to lysosomal pH, transport protein activity and expression, and rates of exocytosis. Our findings thus far support the notion that \(\alpha\)-tocopherol recovers lysosomal function by reducing aqueous volume. We suspect that our studies in the near future will rule out alterations in lysosomal pH and transport protein activity and expression as contributing factors to the mechanism of \(\alpha\)-tocopherol. A mechanistic understanding of how \(\alpha\)-tocopherol ameliorates lysosomal impairments could provide the necessary information to develop a therapeutic treatment for neurodegenerative diseases, one of which has never existed.

Joe Krentz
Tibetan Vernacular and the Contemporary City
Advisor: Kapila Silva, Architecture

Vernacular architecture dominates the bulk of built constructions around the world, though often disappears as societies modernize. In a place like Tibet, kept in isolation and now on the
brink of a literal explosion of changes
the two societies still sit legible in
contrast. What if we learned from these
centuries old traditions and reapplied
them to the needs of a modern city, but
in a responsive way?

**Holly Lafferty**
The Effects of Nutritional Stress on Nitrogen Stable Isotope Ratios in Minnows
Advisor: James Thorp, Ecology and Evolutionary Biology

Analyzing the ratios of the nitrogen stable isotopes N14 and N15 can be used to indicate where an animal falls in a food chain because N14 is preferably excreted by animals, causing them to be enriched in N15. Consumers become even more enriched in the rarer N15 isotope because their food has already been enriched. Studies have shown that nutritional stress could increase the amount of N15 in an animal because it causes it to digest its own tissues. This study looks into the effect nutritional stress can have on the ratio of nitrogen isotopes by feeding mosquito fish in a controlled environment at different rates.

**Devin Lasley**
Employing a Sports Psychology Perspective to Assess an Athlete's Experience Competing in a 100-Mile Race
Advisor: Mary Fry, Health, Sport, and Exercise Science

Competing in extreme endurance races requires extensive preparation, training, and motivation to succeed. The purpose of this study was to employ the Achievement Goal Perspective Theory to analyze the experiences of an athlete who competed in his first extreme endurance race. Specifically, the athlete’s goal orientations (i.e., personal definition of success) were considered in depth. Athlete’s can reflect a task (i.e., success is achieved via high effort and improvement) and/or ego orientation (i.e., success is based on winning/outperforming others). The 27-year-old Caucasian athlete [Jim] participated in an interview one week prior to the race and again one week after the race. Jim described his experience training and participating in the race, events during the race, and feelings or thoughts after the race. He answered questions regarding goal orientations, mental skills, motivational processes, and sports psychology in general. Three researchers conducted qualitative analysis of the interview transcripts, and met to discuss their interpretations, which were highly consistent. Their analyses revealed that Jim displayed high task orientation, reflected in his significant commitment to training hard with a focus on improving each day, and his strong emphasis on the process of developing as an extreme endurance athlete. Jim also revealed aspects of an ego orientation in that he felt he failed when he dropped out of the race at the 96 mile marker. Numerous examples of Jim’s goal orientations will highlight the importance of having a high task orientation to be able to succeed in such a mentally and physically demanding sport.
Wing Yan Lau
Interpreting Conflicting Performance in a Masculine Domain: A Shifting Standards Approach
Advisor: Monica Biernat, Psychology

The shifting standards model demonstrates the tendency for individuals to judge members of stereotyped groups against different standards (Biernat et al., 1991). For example, in the domain of gender stereotypes, prior researches indicate that people set a lower competence standard but a higher ability standard for women than men (Biernat & Kobrynowicz 1997). While many studies have examined shifting standards in gendered domains, few studies have looked at this effect across multiple performances, as well as how conflicting information might change the standard used in making judgments. The current research explores the effect of a shifting standards model between a male and female target across multiple performances in a masculine domain – Engineering. Results indicates that when given conflicting information, framed in terms of performance on two exams, female targets are affected more severely in terms of judgments of their overall GPA compared to make targets with the same performance.

Samuel Long
Characterizing subcomplex formation in septate junction biogenesis in Drosophila embryonic tissues
Advisor: Robert Ward, Molecular Biosciences

The cells in an epithelium are held together by adherence junctions (AJs) along their lateral membranes. Septate Junctions (SJs) are located basally to AJs and function to provide a barrier to the diffusion of solutes between apical and basal environments surrounding epithelial cells in invertebrates. SJs are analogous to the tight junctions found in vertebrates. SJs play a critical role in partitioning an organism allowing for distinct outside and inside environments and organ compartmentalization. Using Drosophila melanogaster, numerous studies have identified transmembrane, extracellular, and cytoplasmic protein components that together form SJs. This formation is initiated by broad localization of proteins along the basolateral membranes of epithelial cells. They are then modified through endocytosis and recycling to localize to the region of the SJ. We hypothesize that this process is dependent on the formation of intermediate subcomplexes in endosomes that are required during the biogenesis of SJs. To test this hypothesis, we are utilizing Drosophila genetics and immunohistochemical staining to examine the localization of known SJ proteins (Mcr, Cor, Atp-alpha, Dlg, Nrv, and Fas3) in the mutated Drosophila strain, Nrx4304. Preliminary data indicates that the localization of these proteins is dependent upon the genetic background of other SJ genes. In our research, it has been shown that Mcr still localizes to the SJ while Cor, Atp-alpha, and Fas3 are all mislocalized along the lateral membranes of epithelium in Drosophila hindguts and salivary glands. These findings, thus far, support the hypothesis that at least 2 subcomplexes are used in the recycling process.
and localization process of the biogenesis of SJs.

Haley McKee
The Relationship between Sports Involvement and Spine Flexibility in Adolescents
Advisor: Elizabeth Friis, Mechanical Engineering

Adolescent Idiopathic Scoliosis (AIS) is a curvature of the spine that appears during early adolescence. Children with curves greater than 30 degrees usually require surgical treatment. The most common surgical treatment for AIS is a spinal fusion, which can be high risk and expensive. Medical companies currently do not have an accurate model of a juvenile spine to test their devices on, and therefore there are many flaws when adult devices are used in children. There is a great demand for the development of a spine model that accurately models adolescent idiopathic scoliosis that can be used in the testing of medical devices. An important consideration for this model is the range of spine flexibility between human subjects. Adolescents often participate in competitive sports that can require a great degree of flexibility, depending upon the sport. It is necessary to understand whether athletic involvement in specific sports causes a wide range of spine flexibility. If little variation is discovered, a single spine model can accurately mimic the average mechanical properties of an adolescent spine. If there is a significant difference in the spine flexibility due to sports involvement, then multiple spine models must be developed to accurately account for these differences. This information is crucial in the development of a model(s) that accurately represents the mechanical properties of an AIS spine. The purpose of this study was to find any correlations between spine flexibility and sports involvement, and to account for these differences in the final spine model.

Jennifer Mendez
An evaluation of Fasciclin 3 (Fas3) as a core component of the septate junction of Drosophila melanogaster
Advisor: Robert Ward, Molecular Biosciences

In all multicellular animals, polarized epithelial cells provide a barrier that keeps the apical and basolateral environments separate. This barrier function is required to keep the organism safe from outside intrusions and for the normal function of internal organs. This barrier is accomplished by formation of junctions between epithelial cells along the lateral membranes. In vertebrates, these junctions are called tight junctions (TJ), which function like and require many of the same components as the invertebrate septate junctions (SJ). Our lab is interested in understanding the assembly of the SJ, Using Drosophila melanogaster as a model organism. SJs in Drosophila melanogaster are composed of many extracellular, transmembrane and membrane–associated cytoplasmic proteins that act together to form a highly cross-linked protein barrier. Fasciclin 3 (Fas3) was one of the first proteins identified to localize in the SJ, but a complete characterization has not been conducted.) We have examined the
terminal phenotypes of Fas3 mutants and have also examined Fas3 protein localization in 20 different SJ mutant backgrounds. Surprisingly, Fas3 does not exhibit normal SJ phenotypes, suggesting that Fas3 is not a core component of the SJ. However, we also identified two potential proteins that are core SJ components that may interact with Fas3.

**Arianna Morgart**
Gender and Maternal Responsivity as Factors in Number of Conversational Turns in Adolescents with Developmental Disabilities
Advisor: Nancy Brady, Speech-Language-Hearing

This study examines factors that influence interactions between adolescents with mild to moderate developmental disabilities (DD) and their mothers. It was hypothesized that girls would take more conversational turns than boys, and that higher maternal responsivity would be associated with more conversational turns taken by the adolescent. Each mother-child dyad was visited in their home and asked to interact naturally for 30 minutes. Interactions were videotaped and transcribed; transcripts were analyzed using Systematic Analysis of Language Transcripts (SALT) software. Measures obtained from SALT analysis were: number of total utterances, number of different words, and mean turn length for mother and adolescent. Responsivity was coded by two independent coders. Mothers were rated from 1 to 5 on six dimensions of maternal responsivity: affect (positive or negative), warmth, flexibility, control/discipline, guidance, and punitive tone. A preliminary analysis of the data (N=5) indicates that on average when mothers were interacting with their adolescents, mothers showed high levels of maternal responsivity and low levels of negative affect and punitive tone. Gender differences in maternal responsivity will also be discussed. Conversational differences between mother-daughter and mother-son dyads will be presented, as well as the relationship between conversational differences and maternal responsivity.

**Mitchell Newton**
Utilizing Microdialysis to Monitor Biomarkers In Vivo through Capillary Electrophoresis
Advisor: Craig Lunte, Chemistry

Chemobrain is a patient reported symptom of chemotherapy that is reported after administrant of the chemotherapeutic drugs. Loss of memory and cognition appear to accompany the onset of the chemotherapeutic drugs. In this experiment, samples were taken from an awake male Wistar rat as it underwent a modified chemotherapy meant to be analogous to human breast cancer patients. The objective of this project was to go through samples taken from this experiment of the rat and try to observe changes seen in the analyte of interest, malondialdehyde, or MDA. Study was completed with this biomarker of oxidative stress, MDA, known to be a stable product of lipid peroxidation from reactive oxidative stress species. The analysis was carried out using a capillary electrophoresis system.
Alyssa Ong
Alternative Breaks: Their Impact on Students’ Perceptions, Attitudes and Behaviors
Advisor: Catherine Schwoerer, Business

In 2010, 72,000 students across the United States participated in Alternative Breaks. This project seeks to build on the previous research on the influence Alternative Breaks have on students’ sense of self, others and the community. Previous studies mainly relied on qualitative data while focusing on one group of students. This study’s design will include three groups of students: Alternative Breaks participants, students who engage in a party break, and a control group of students who do not go away for a break. Having three groups will allow for better comparison in measuring the perception, attitude and behavioral changes in participants of Alternative Breaks with students who engage in other activities. The students who choose to go on party breaks will serve as the comparison to students who participate in Alternative Breaks. The inclusion of the control group strengthens our ability to attribute any changes to these experiences. Qualitative and quantitative data will be collected through pre-break and post-break questionnaires. The qualitative data will provide a deeper understanding of students’ expectations of their breaks and their experiences. In addition, the quantitative data will give insights into the different characteristics of participants, why they chose the specific break, and how much they learned as a result. Data collected will also allow us to understand how students’ career values and motivation to volunteer is affected by the activities they engage in over the break. This research would benefit Alternative Breaks programs across the country as well organizations which run similar programs.

Nilam Patel
Investigation of Biochemical Changes in Seizure Affected Brain Tissue
Advisor: Elias Michaelis, Pharmacology and Toxicology

The aim of this proposal is to investigate and analyze biochemical changes in brain tissue of individuals affected by a severe form of recurring, intractable seizures. Electrical signaling is critical for normal brain function and seizures occur when normal neuronal electrical signaling is deregulated, usually for short periods of time, causing symptoms ranging from altered behavior, tense stature, muscle spasms, and even loss of consciousness[1]. Causes for abnormal electrical signaling range from an imbalance of excitatory neurotransmitters, head injury, stroke, adaptation of neuronal membranes to environmental changes, etc. with many cases of seizures having unknown causes [1]. Seizures or epileptic events affect about 1 in 100 individuals in the United States and usually can be treated through pharmacotherapy, but about 25% of affected individuals do not respond to therapy and suffer from intractable epilepsy [1]. With such a high incidence rate of affected individuals, unclear explanations of the causes of abnormal firing, and a large number of affected individuals who are
nonresponsive to treatment, there is
great demand for further research in
this disorder. The current project is
designed to investigate changes in
tissue chemistry in brain samples
obtained from individuals suffering from
recurrent, intractable seizures for whom
the only cure is surgical removal of the
area of the brain that functions as the
focus of initiation of the seizures.
[1] "Seizures and Epilepsy: Hope
Through Research," NINDS. Publication
date May 2004.

Kyle Patterson
The Magnet or the Men?: Path
Dependence and Political Polarization
Through the Prism of National
Budgetary Disputes
Advisor: Michael Lynch, Political Science

In the following paper I will examine the
question of partisan polarization
through the lens of a single issue: the
national debt/deficit debate. This paper
will explore the history of this
contentious topic and the debates
surrounding it, beginning with the
foundations of the modern
Congressional budgetary process and
ending with a detailed discussion of the
Budget Control Act of 2011. After
establishing that the contemporary
trend of polarization is indeed aberrant
from the past, I will then attempt to
provide an explanatory framework
addressing why this is. This framework
will borrow from the work of “path-
dependence theory”, a social-scientific
theory that was originally developed to
explain technological change and
development. Path-dependence theory
attempts to explain social phenomena
by performing a genealogy of sorts that
explores the conditions surrounding a
situation or institution at its
establishment and throughout its
existence. In this case specifically, the
focus will be on the interaction between
choices of political institutions and
programs and how these initial
conditions constrain the options of
technocrats and government officials in
the future. This paper will build upon
the work of Paul Pierson which,
“conceptualizes path-dependence as a
social process grounded in a dynamic of
increasing returns” (Pierson, 2000, p.
251). I will apply the structure of and
insights from this theory to contend that
the United States is on a nearly
inalterable path of debt accumulation.
This analysis will, hopefully, clarify
where we are, how we got here and
why we are unlikely to ever effectively
change course.

Brenna Paxton
INDEX
Advisor: Jeremy Shellhorn, Design

INDEX is a series of photobooks and
zines that creatively document my
exploration of time, location, and
memory. Volume Five of INDEX features
work from my Undergraduate Research
Award project, in which the relationship
between color and culture is
questioned.

Rubie Peters
How Locus of Control Relates to One’s
Knowledge and Perception of Evolution
Advisor: Patricia Hawley, Psychology

Teaching the theory of evolution in the
United States has been a controversy in
the education system for decades.
Previous research done by Hawley and colleagues (2011) has found a strong positive correlation between political/religious conservatism and creationist reasoning and a negative correlation between political/religious conservatism and knowledge and relevance of evolution. There’s also a strong positive correlation between an internal locus of control and conservative ideology (Gurin et al, 1978 & Thomas 1970) as well as a strong correlation between an internal locus of control and religiousness (Gabbard, Howard, & Tageson, 1986 and Jackson & Coursey, 1988). Developed by Rotter (1966), one’s locus of control is described as the belief that life’s outcomes are contingent on what people do (internal control) or determined by outside forces, such as luck or powerful others (external control). The present study predicts to find that one’s locus control is a significant predictor of not only one’s political and religious conservative ideology but also a significant predictor of creationist reasoning in the Evolutionary Attitudes and Literacy scale. Preliminary results have indicated a relationship between an internal locus of control with creationist reasoning and a person’s knowledge and relevance of the theory of evolution. Preliminary results have also indicated a lack of significant between locus of control and political/religious conservativism. Further analysis is currently being conducted. With this research, we hope to understand as to why people reject the theory of evolution and improve teaching methods when it comes to the theory of evolution.

Erin Reid
Separation Optimization of L-DOPA and its Metabolites Using Microchip Electrophoresis with Electrochemical Detection
Advisor: Susan Lunte, Chemistry

The dopamine metabolic pathway consists of a family of compounds which are of intense interest due to their role in many important brain functions including behavior, stress, memory, and mood, as well as their implication in addiction and other neurological disorders. Current methods of analysis for these compounds in conscious animals employ biosensors or microdialysis, involve tethering the animal to the analytical instrumentation, and necessitate a trade-off between monitoring only one analyte at a time (biosensor) or multiple analytes off-line (microdialysis). A system that allows for near-real time, analysis of multiple analytes in awake and freely-roaming animals would allow better correlation between analyte concentration and behavior. A system which integrates microchip electrophoresis with electrochemical detection is being developed to do just that, but currently has several obstacles to overcome for monitoring L-DOPA metabolites in vivo. These include poor resolution between specific analytes and inconsistency both run-to-run and chip-to-chip. Potential solutions to these challenges were investigated. The performance of a PDMS/glass microchip was compared to that of the standard PDMS/PDMS microchip. Analysis of the data revealed that the hybrid PDMS/glass chips yield more consistent
results and a notable longer lifespan, but are less efficient. The effects of several buffer modifiers were also explored, including several organic modifiers and a boric acid derivative known as 3-NPBA. There was no improvement in resolution for any of the organic buffer modifiers, but the possibilities of 3-NPBA are still being explored. Ultimately this device will be paired with brain microdialysis for online, near-real time analysis.

Evan Reznicek
Analysis of Thermoelectric Devices as a Means of Condensing and Retaining Moisture
Advisor: Christopher Depcik, Mechanical Engineering

The purpose of this project is to analyze thermoelectric devices as a means of condensing and retaining moisture. Specifically, the goal is to build and test an apparatus that utilizes thermoelectric devices to cool the surface of a duct through which warm, moist air will flow, such that the air condenses to the cool surface and drains to a receptacle. The warm, moist air is representative of waste steam from power generation or industrial processes that would otherwise evaporate into the atmosphere. Water consumption is becoming an ever more pressing issue with thermoelectric power generation, and as the world population grows, demand for both water and electricity is also rising. The dilemma that this situation creates is aptly named the water-energy nexus, and this project seeks to analyze ways of remedying this problem.

Research was conducted on TECs and some basic calculations were performed to determine the type and size of TECs required for this project. It was decided that three 60 Watt TECs would be used to cool one surface of a 2" x 1" x 12" aluminum duct. It was found that with proper heat sink cooling, 60 W TECs can reach cold side temperatures of approximately 1 degree Celsius; perfect for condensing water. The duct that these TECs will cool is currently under construction. Construction is expected to be completed by April, and in the ensuing weeks the apparatus will be tested and modified. The results of these tests will be presented at the Undergraduate Research Symposium.

Haley Robb
Depression and Coping Mechanisms
Advisor: Rick Ingram, Psychology

Depression affects 1 in 10 Americans (Centers for Disease Control). Research has long shown that women are more susceptible to depression than males. One possible explanation for this difference is the different coping styles of male and women. We hypothesized that the persons’ gender mattered less in regard to their coping style than did their high masculinity and/or low femininity. People with high masculinity and/or low femininity coping mechanism have lower rates of depression. Participants were given a series of tests to determine their masculinity/femininity and coping styles. Then, part of the sample underwent a negative mood induction while the other portion received a neutral mood tape. After the tape participants were again give questionnaires about
mood and coping styles. The results showed that people who had high musicality scores were less likely to have negative coping styles.

**Alexandria Roy**
Identification of miR-137 Targets in Colon Cancer
Advisor: Liang Xu, Molecular Biosciences

MicroRNAs (miRNAs) are non-protein coding RNAs that negatively regulate gene expression by inhibiting protein translation. miRNAs are frequently dysregulated in many types of cancer, resulting in aberrant gene expression. We recently identified miR-137 as a tumor-suppressive miRNA, and found its expression decreased in approximately 70% of colon cancer tumor samples, as compared to normal tissue. Furthermore, when we re-expressed miR-137 in cancer cell lines, we reduced cell growth, colony formation, and tumorsphere growth. We identified oncogene Musashi-1 (Msi1) as a target of miR-137. However, microRNAs such as miR-137 are known to regulate hundreds of genes, therefore, our goal is to identify additional targets of miR-137 that may be over-expressed in colon cancer. We hypothesize that the loss of miR-137 in colon cancer results in an over-expression of oncogenes, such as Msi1, contributing to colon cancer initiation and progression. Using miRNA-prediction programs, PicTar and TargetScan, we identified predicted targets of miR-137. Colon cancer cell line, HCT-116 was transfected with miR-137 mimic for 24-48 hours and total RNA was isolated. Then RNA was converted to cDNA using reverse-transcription PCR and cDNA expression of our genes of interest was measured using quantitative real-time PCR (qRT-PCR). By identifying additional miR-137 targets, we hope to gain a better understanding of colon cancer etiology. Additionally, understanding the role of miRNAs such as miR-137 is important to developing miRNA-based molecular therapy, deliverable to tumors via Dr. Xu’s patented nanoparticle.

**Kayla Sale**
Comparing stomatal characters in glacial and modern conifer leaves
Advisor: Joy Ward, Ecology and Evolutionary Biology

During glacial times, low atmospheric CO2 concentration (ca) may have limited photosynthetic capacity (Amax) in plants. However, adaptations in leaf morphology, such as variation in leaf mesophyll thickness and increased stomatal conductance (gs), which may be increased by increased stomata on the leaf surface, may have increased CO2 uptake and thereby Amax. 13C isotope data shows that leaf intercellular CO2 concentration (ci) was lower in in glacial as compared to modern times, which may have limited Amax in glacial conifers. A trend of increasing ci/ca from glacial to modern times suggests different stomatal regulation or possibly higher Amax in glacial versus modern conifers. However, a trend of decreasing (ca – ci) gradient from Holocene to modern times suggests facilitated CO2 uptake through glacial plant leaves. These three factors suggest glacial conifers may have had a higher Amax than modern species, indicating a mechanism for
enhanced CO2 uptake. Thus, the following hypotheses were proposed: During glacial times, increased stomatal index (SI, the number of stomata per epidermal cells) reduced resistance to CO2 diffusion into leaves, thereby raising ci. Plants that differ in drought tolerance may differ in ability to increase gs as a strategy to improve C gain. Glacial (40,000 years old) pine and juniper samples from pack rat middens provided a comprehensive set of ancient plant leaves of the same genus from the same geographic region with multiple replicates. Samples were analyzed using epifluorescence and a scanning electron microscope in order to quantify SI, stomatal pore size, and leaf area.

**Allen Schaidle**
Understanding Cultural Intelligence and Nurturing Global Consciousness
Advisor: Joe O'Brien, Curriculum and Teaching

With globalization comes a rise in multicultural societies. In today's society it is becoming more critical for individuals to take part in multicultural environments and effectively navigate these diverse environments. The main focus of the presentation will center on the concept of cultural intelligence. As scholar and writer David Livermore states, “Cultural intelligence is often defined as the capability to function effectively in a variety of cultural contexts.” As interactions between individuals of diverse backgrounds increase, students will require cooperative skills for diverse situations. This presentation will provide real life examples and exercises focused on helping young career-seeking individuals develop their cultural intelligence.

When individuals encounter multicultural environments they often become anxious as they address issues of culture. Furthermore, without proper knowledge or training, people tend to minimize cultural differences and become paralyzed by the fear of producing culturally/politically incorrect responses. Thus, in today’s global markets individuals need to become educated in the complexities of a global society in order for success. In the lecture I will give examples of how individuals can become more globally sensitive in order to better their function in diverse environments. Increasing one’s cultural intelligences provides a “road map” for navigating multicultural encounters by not simply providing individuals with superficial facts on cultures, but by creating knowledge through teaching individuals to interpret and evaluate cultures. Attendees will walk away with a better understanding of how to approach diverse cultural situations with confidence in their future careers.

**Sebastian Schöneich**
The role of CDH-4 in neuroblast migration in the nematode *Caenorhabditis elegans*
Advisor: Erik Lundquist, Molecular Biosciences

The migration of neurons is important for proper nervous system formation. A developing neuron must migrate to its programmed destination, a process guided by developmental cues and not fully understood. Defects in migration
can result in neurological disorders, so it is important to understand the signaling pathways involved in neuronal migration. The nematode *Caenorhabditis elegans* has a completely sequenced genome, 302 neurons, and shares conserved genes and molecular mechanisms with humans. We use the Q neuroblasts (QR and QL) that migrate along the anterior-posterior axis in *C. elegans* to study neuronal migration. QL on the left gives rise to PQR, which migrates posteriorly. QR on the right gives rise to AQR, which migrates anteriorly. Previous studies (Sundararajan and Lundquist, 2012) suggest a tentative model for Q cell migration involving the proteins UNC-40/DCC, MIG-21, and PTP-3/LAR, which direct posterior migration in QR and QL. In QL and QR, UNC-40 and MIG-21/PTP-3 act in parallel pathways and autonomously in directing posterior protrusion and migration. In QL, UNC-40 and MIG-21/PTP-3 act redundantly to direct posterior migration of PQR. In QR, UNC-40 and MIG-21/PTP-3 mutually inhibit each other’s role in posterior migration, resulting in anterior migration of QR. CDH-4, a fat-like cadherin, was identified in a mutant screen of genes that affect AQR and PQR migration. We found that CDH-4 inhibits posterior migration caused by UNC-40 and PTP-3 in QR, suggesting that it is involved in the above mentioned pathways. Current projects aim to better understand CDH-4’s role in QL and its interaction with MIG-21.

**Joseph Siess**

The Reconstruction of the Moroccan Jewish Identity From the French Protectorate to Moroccan Independence: 1912-1956

Advisor: Marie Grace Brown, History

French colonialism in Morocco was an experience shared by both its Muslim and Jewish inhabitants, who were surrounded by the same walls separating the conquered from the conqueror. The French conquest of Morocco, a physical and cultural conquest, caused Moroccans—both Muslim and Jew—to reconstruct their cultural, national, and ethnic identities. By the time the French left Morocco in 1956, Moroccan Jews faced a second challenge to their identity as they found themselves caught in the middle between the fervent expansion of pan-Arabism and the Zionist movements; not fully accepted by either. The Alliance Israélite Universelle, a Jewish humanitarian organization based in Paris France, existed in Morocco 50 years prior to French colonial penetration. Zionist influence as well, was present in Morocco only a short time after its politicization at the Basel conference in 1897. My project focuses on literary primary sources as well as archival research performed at the Alliance Israélite Universelle archives in Paris France. My research in Paris provided information about the activities of the Alliance Israélite Universelle, and by extension, the French protectorate, as well as the effects of Zionist influence on the Moroccan Jewish identity. Finally my project aims to outline the effects of various factors, which led to this reconstruction of Moroccan Jewish identity, and the ultimate mass exodus
of Moroccan Jewry after Moroccan independence in 1956.

**Myette Simpson**
Understanding Spine Range of Motion in Correlation to Body Mass Index of Children
Advisor: Elizabeth A. Friis, Mechanical Engineering

When determining the plans for spinal surgery for those children who have severe cases of Adolescent Idiopathic Scoliosis, flexibility of the spine is an important factor to look at to find the best type of fusion to perform. There has been a wide variety of research done to understand spinal flexibility such as determining the best way to measure flexibility, flexibility in relation to the different lifestyles and examining the mechanics of the spine itself. Although the aspect of the fitness of the body has been highly overlooked. The purpose of this study is to measured the flexibility of the spine in comparison to a child’s body mass index to see if there are any trends in ones body weight and flexibility of the spine. The data analyzed was data that was collected from a previous experiment. Results showed that people with a BMI range of 22.3 to 22.4 tend to have the largest range of motion. Post questions that arise from the data include looking at the ratio of muscle to fat and the effect it may have on the spine. Factors that could be avoided for further research would be a longer timeline for the project and more subjects.

**Elizabeth Sims**
Obsession: Body Alteration and Modification

I am interested in examining the insecurity that plagues women in contemporary society. The conglomeration of media that bombards women with depictions of the unattainable western “ideal” is detrimentally impactful, and offers a compelling and vital topic for me to explore in my work. My own experience with this frustrating battle gives me insight, as I derive inspiration from the beauty industry, fashion culture, and pop culture. My work currently focuses on appearance modification and the disconcerting results this produces—mentally, physically, and emotionally—for the modern woman.

My process starts with medical research into recent developments in appearance modification, especially that which is shocking and extreme. This research provides insight to produce works that explore obsession with the body, often utilizing my own body as subject. I use a variety of materials: bold colors that reference cosmetics, sewing patterns to mirror the dissection and physical cutting involved in body modification, and digitally-altered photographs that reference the fashion world, a field that places so much pressure on women’s bodies.

My aim is to confront the viewer with disconcerting, doll-like, or grotesquely monstrous figures modified and distorted through plastic surgery or heavy make-up. By critiquing the beauty and fashion industries, and cosmetic surgery practices, I hope to draw attention to the disturbing ramifications for “real” women who adopt this ideal. I am passionate about the topics I
address, and hope, though my art, to reflect upon beauty, self-confidence, and the consequences of extreme body alteration and modification.

Spyros Siscos
Computerized Neurocognitive Assessment Tests and Detection of the Malingering Athlete
Advisor: Phillip Vardiman, Health, Sport, and Exercise Sciences

Returning to play after suffering a concussion remains a sensitive and difficult subject for athletes, physicians, and other allied health professionals. Concussed athletes may experience considerable pressures to immediately return to play from themselves, their coaches, parents and peers. Therefore, it is important to possess valid and reliable neurocognitive assessments (NCAs), such as the ImPACT NCA (ImPACT Applications, Pittsburgh, PA), to assist in accurately determining when an athlete may safely return to play. Furthermore, such tests must be capable of detecting a malingering athlete to prevent invalid assessments that could result in a pre-mature return to play decisions.

The purpose of this study is to examine the validity of the ImPACT Neurocognitive Assessment and its ability to detect a malingering athlete. Twenty rugby athletes performed two ImPACT NCAs one week apart from each other. During the first NCA, the participants were instructed to perform to the best of their ability. Before beginning the second NCA, the participants were instructed to attempt to perform in a manner that would generate a lower baseline score relative to their “true” baseline score as seen from their first NCA. A blind analysis of the assessments will be performed by a practicing physician. A pre-test post-test design will be used to assess the change in scores. An independent t-test will be used for statistical analysis with an alpha level =0.05.

Ryan Smith
Concerning Hobbits: The Hobbit, The Lord of the Rings, and the Trauma of the 19th/20th Century Transition in English Culture
Advisor: Mary Klayder, English

This research looks at Tolkien and his texts, The Lord of the Rings and The Hobbit. Examining these texts, as well as scholarship written upon them, I argue the journey undertaken by Frodo and his Halfling companions can be understood as the painful transition between the literary modes of the 19th century fairytale (as found in The Hobbit and initial chapters of The Lord of the Rings) and the 20th century postwar novel (as found in the concluding chapters of The Lord of the Rings). This paper makes the claim that Tolkien uses the anachronistic hobbit culture as a means through which to understand the trauma of the shift in English identity between the idealized Victorian era and the urban, industrialized, postwar 20th century, coming to terms with modernist fracture through the euphemism of the fantasy genre.

Rachael Snider
Abortion Rhetoric and the Media
Advisor: Dave Tell, Communication Studies
This thesis attempts to explain the rhetorical techniques used by the modern progressive movement and the traditional resistance movement on the abortion reformation within the framework of media representation. My goal is to draw attention to the mass media’s role in shaping perceptions of the public throughout the abortion debate utilizing the media’s persuasive rhetorical tactics. The social movement started in the early 1960’s; two opposing viewpoints juxtaposed one another, both competing for prominence in media coverage. This thesis looks at the relationship between abortion and the mass media, and the ways in which the rhetoric surrounding the abortion debate helped shape the social climate of the abortion discourse. The focus is on the rhetoric leading up to and surrounding the 1973 Supreme Court Decision in Roe v Wade, which federally legalized abortion. The rhetoric is analyzed from the lens of media representation and audience outcome. My interest lies in how the press surrounding the abortion discourse chose to represent both sides of the conflict. More specifically it looks at agenda setting; analyzing preferred framing techniques and framing effects, salience effects and bias within mass media representation of the rhetoric. I explore how the Liberal Progressive Movement and the Traditional Conservative Movements conflicting rhetorical definitions on abortion get played out in the discourse of the mass media and the audience effects that respond to the persuasive rhetorical techniques.

Kenneth Stowe

The Rhetoric of Christian Identity: Myth and Paranoia
Advisor: Robert Rowland, Communication Studies

The Christian Identity (CI) movement is a particularly racist offshoot of the earlier Anglo-Israelism (AI) movement that believes that all non-Anglo whites are the literal descendants of Satan. The function of myth building within the CI movement is identified by four characteristics: larger than life characters, occurs outside the normal historical timeframe, occurs in a symbolic or supernatural place, and the use of archetypal language. Each of these characteristics is found to help build identification with the racial struggle of whites throughout history and adversity in the face of governmental conspiracies. Hofstadter identifies four key characteristics of the paranoid style: the depiction of a sustained apocalyptic conspiracy, the depiction of the opposition as superhuman and sinister, the presence of a paranoid leader, evidence-laden demonstration. The presence of paranoid style within the texts demonstrates the cognitive link between the mythic form of CI rhetoric and the violent actions that are often carried out by those who identify themselves as adherents to the movement. This study suggests that while many religions espouse beliefs that are apocalyptic and over suspicious of other races, CI rhetors are able to create an environment of militant immediacy that is at odds with most of American society. This study also suggests that the use of paranoid style
leads to an atmosphere of overt racism, suspicion of governmental structures, and sometimes acts of extreme violence.

**Bryce Tappan**  
Mapping of Four Indigenous Tawahka Communities  
Advisor: Peter Herlihy, Geography

I am mapping four communal land grants from the Honduran government in ArcGIS. The documents that delineated the boundaries of the communal land grants were written out long-hand in Spanish, so we had to take those documents and convert the data they contained into a more workable form before any work in GIS could be done. The indigenous people who live on this land are fighting for legal ownership of the land, so creating official, more accurate maps for the region could help them in their struggle.

**Haider Tarar**  
Designing Optimum Protein-Excipient Interactions using Molecular Docking Simulations  
Advisor: Kyle Camarda, Chemical & Petroleum Engineering

Protein drugs are being increasingly used in the pharmaceutical industry. The tendency of proteins to aggregate adversely affects the storage and delivery of a stable protein drug product. Aggregation limits the effectiveness of pharmaceutical proteins and may even lead to severe immune response. Excipient formulation can be used to reduce the probability of the protein aggregating through interaction with aggregation prone regions on the protein structure. Excipients can be described as the inactive ingredients in medicine that help hold a dose of the active pharmaceutical ingredient (API) together and keep it stable for a long shelf life (Ritter, 2008). In this project, molecular docking simulations are used to predict regions of protein-excipient interaction. The results of these simulations are compared with the results of hydrogen/deuterium exchange experiments (which experimentally determine regions of protein-excipient interactions) done at Purdue University. Aggregation prone regions of the protein are predicted using Aggrescan (Conchillo-Sole, et al., 2007). Protein-excipient interaction regions and Aggregation prone regions are used to design excipients which provide maximum protection to aggregation prone regions and thus reduce the tendency of the protein to aggregate. My work predicts protein-excipient interaction regions. I created the files needed for docking simulations and then performed molecular docking simulations using Autodock (http://autodock.scripps.edu/). The simulation showed the locations on the protein where the excipient is most likely to interact visually as well as indicated the residues which interact with each docking conformation. I recorded the residues for each conformation and used them along with the experimental results to plot a histogram of protein-excipient interactions.

**Liza Tauscher**  
Diversity Oriented Synthesis Strategies to Benzofused Sultam Libraries:
Discovery of Small Molecule Modulators of Biological Pathways  
Advisor: Paul Hanson, Chemistry

The development of diversity-oriented synthetic strategies has allowed for the rapid production of diverse benzofused sultams scaffolds for library production. The strategies include reaction pairing and complementary pairing. Efforts toward the preparation of benzofused libraries in conjunction with high-throughput screening (HTS) within the NIH-MLPCN (NIH-Molecular Libraries Probe Center Network) have revealed a number of novel sultams exhibiting potent activity in the modulation of a variety of protein targets. These proteins include: TGF-β, NF-κb, Schnurri-3, and glucogen-like peptide I receptor and Gemnin. In this regard, we herein report the corresponding synthesis and HTS data from the NIH-MLPCN of the titled sultam libraries.

Paul Thomas  
Archaeological Survey of Center Chapel, Franklin County Kansas  
Advisor: Philip Stinson, Classics

The purpose of this research proposal is to document the ruins of a small chapel known as Center Chapel in Franklin County, Kansas using basic archaeological techniques in order to create a virtual reconstruction of the site. In addition to on-site fieldwork, the project will require extensive research through the Franklin County Historical Society Records Center. The chapel ruin, located in a small patch of trees, now lies off the southwest junction of Oregon and Pawnee Road in the eastern part of Franklin County. By researching and excavating the ruin, I hope to find when the chapel was created, who created it, and why it fell into disuse. This research project would be extremely significant to my familiarity with basic archaeological procedure; documenting it will allow me to gain an understanding for surveying techniques. These techniques will prove invaluable because I wish to pursue a graduate degree pertaining to classical archaeology, which will involve larger-scale excavations. Despite the size of the Center Chapel ruin, however, the basic tenants of excavation archaeology will remain the same.

Rodolfo Torres-Gavosto  
Derivatization of the azulenic framework along its molecular axis for self-assembly on gold surfaces  
Advisor: Mikhail V. Barybin, Chemistry

With an increased demand in alternatives to silicon dependent circuitry, the development of materials relevant to molecular devices becomes essential. Azulene, a polar nonbenzenoid aromatic hydrocarbon, represents an intriguing example of a simple molecular diode. Self-assembled monolayer (SAM) films of properly functionalized azulenic motifs on metal surfaces constitute convenient platforms for developing new charge transport materials. In this presentation, we will introduce the syntheses of several linearly functionalized azulenic derivatives featuring isocyno, cyano, and/or mercapto substituents. Self-assembly of these species on metallic gold surfaces, as well as properties of the corresponding SAMs, will be discussed.
Mariah Trevizo
New Orleans Culinary Incubator: Experience, Integrate, Create
Advisor: Shannon Criss, Architecture

New Orleans is a prime example of a city that has revitalized itself, and continues to make strides to bring communities together. With this project, I aim to revitalize the community in this area and help strengthen the idea of community involvement in architecture. Through the module of experience, integrate, and create I promote members of the community to first go and experience the site, get involved in the programs offered, and then contribute to the site itself through their own creative abilities.

This culinary incubator/lab exists to serve the community by providing programs that educate on healthy food choices, growing and buying local food, and reaching out to disadvantaged members of the community. Some of the programs that are incorporated into this project, such as Liberty’s Kitchen, The Stop, and mobile urban farming, reach out to the community by either helping the disadvantaged youth, or providing classes and workshops that educate the community on local foods. Some of the other programs include a commercial kitchen and business incubator which will help young entrepreneurs advance their culinary careers.

Another major aspect of this project is the site design. One of the major inspirations I gathered from the site was the graffiti on the existing buildings. I am bringing that idea of graffiti and bold graphics into the site. Local artists will be able to come and have designated spaces to put up their artwork. This site will become very industrial in nature and promote the idea of gathering the community whether it is for an urban farming project or to skate the new contours of the site. This poster presentation will frame the issues facing this specific community and the design process taken to address those issues through this Culinary Incubator.

Christopher Trezza
The Genetics of the Maintenance of Single-Celled Tube Diameter in C. elegans
Advisor: Matthew Buechner, Molecular Biosciences

The maintenance of diameter of biological tubes is essential for the continued functioning of many organismal functions. The excretory canal cell of the nematode C. elegans provides a model of a long, narrow single-celled tube similar to those of mammalian capillaries and glia. The canals extend along the entire length of the worm to regulate organismal osmolarity, and are maintained by proteins coded for by exc genes. EXC proteins maintain the diameter of the lumen of the canals, by assisting the trafficking of vesicles from early endosomes to recycling endosomes. Mutations in the exc-9 gene cause shortened canals swollen into large, fluid-filled cysts. EXC-9 is an excretory cell protein homologous to human CRIP proteins, which are highly expressed in mammals but whose function is not yet known. exc-9 shows genetic
interactions with the exc-1 and exc-5 genes, and EXC-9 binds to EXC-1 in a yeast two-hybrid assay. Using canal-specific subcellular fluorescent markers, we are examining the effects of exc-9 mutation on the movement and persistence of endosomes, and their effects on shape and function of the excretory canals.

Timothy Turkalo
Ewing’s sarcoma protein EWS regulates skeletogenesis
Advisor: Mizuki Azuma, Molecular Biosciences

Ewing’s sarcoma is the second-most prevalent form of bone cancer in adolescents, accounting for 250-300 deaths per year. Over 85% of Ewing sarcoma tumors carry a chromosomal translocation that fuses the N-terminus of the EWS gene to the C-terminus of the ETS transcription factor FLI1 gene. We previously demonstrated that EWS/FLI1 has dominant negative activity on EWS through physical interaction. How inactivation of EWS by EWS/FLI1 contributes to oncogenesis is unclear. Using a zebrafish model system, our lab has shown that EWS is required for normal bone development in maternal-zygotic (MZ) ewsa knockouts and thus have established a link between normal EWS function and the tissue-specificity of EWS/FLI1 tumorigenesis. Moreover, a role for EWS has been revealed in alternative splicing of the cell cycle control protein Cyclin D1. I hypothesize that EWS regulates the splicing of genes that control cell growth and proliferation in neural crest cells, which contribute to the deformed bone structures that we have observed. Cells containing the EWS/FLI1 translocation would be inhibited for this activity due to EWS/FLI1’s dominant negative activity on EWS, leading to uncontrolled cell growth.

Kayci Vickers
Effects of Transcranial Direct Current Stimulation Over Prefrontal Cortex for Decision Making and Creative Problem Solving
Advisor: Evangelia Chrysikou, Psychology

Cognitive control refers to one’s ability to maintain task-relevant information while gating task-irrelevant information in the context of complex cognitive tasks. Previous studies have shown that there may be benefits to both increasing and reducing cognitive control, depending on the task at hand, and further that training regimens aimed at altering levels of cognitive control can affect performance on various types of problem solving tasks. This study attempts to incite states of increased or reduced cognitive control using transcranial direct current stimulation over the left dorso-lateral prefrontal cortex. Specifically, excitatory stimulation is used in this area with the goal of increasing cognitive control and in turn improving performance on a decision making task (the Iowa Gambling Task). Similarly, inhibitory stimulation is used to reduce cognitive control with the goal of improving performance on a creative problem solving task (the Embedded Figures Task). The results of this study help to inform the literature on the neurocognitive mechanisms underlying
cognitive control and may help to localize an area of the prefrontal cortex which can be manipulated to have a large effect on this facet of cognition.

**Matthew Visser**  
United States Intervention in Africa: The Legality of Building Nations  
Advisor: Sharon O’Brien, Global & International Studies

My research examines the United States’ integrity in international affairs by analyzing the recent military intervention on the African Continent (1990-2012). As the need arose for tactically proficient troops to defend peace and train foreign militaries on the continent, in 2007, the U.S. created U.S. Africa Command. The argument for this command post was initially to bring peace to Africans. This paper discovers a working definition for what the purpose of AFRICOM was intended to serve, before its creation, as presented to the U.S. Senate Armed Service Committee and examines what that purpose has evolved into. Case studies in Sudan and Mali do not support the original arguments for AFRICOM. In both instances the reason for AFRICOM has shown the U.S. as an imposition for stronger U.S. presence on the continent, while commandeering strategic geopolitical territories and forming alliances with oil-rich states. This study is one of few examinations of U.S. involvement in Mali since the al-Qaida in the Islamic Maghreb’s successful coup d’état overthrew Mali’s government in March 2012. The U.S. allows these acts of terrorism to a formerly very successful democratized West-African state despite their self-proclaimed intention of bringing peace to Africa. AFRICOM troops were ordered to withdraw from Mali. The AQIM extremists were left to exile thousands of Malians, making Niger carry the weight of the new refugees. As the definition continues to evolve, spectators are left with the unanswered question how often has Capitol Hill deceived the American public and the international community, due to their inability to be honest, or clearly define what is the purpose of AFRICOM.

**Stoney Weaver**  
Fallen Idols  
Advisor: Scott Jenkins, Philosophy

My goal is to create a comic that instills philosophical concepts and self-reflection within the reader. This is achieved by conveying a plot strictly through the visual medium. There will be no readable dialogue within the comic. The comic is named Fallen Idols after a theme within the comic. The narrative of the comic will follow two factions of humans that hold different beliefs. Through various influences this causes a conflict. The comic follows these two factions from before the conflict starts to the conflicts’ violent resolution. The use of violence within the comic is not for the sake of violence or entertainment, but to express a sense of beauty that is prevalent in everything including violent retaliation.

**Samuel Wester**  
The Chelyabinsk Event: A Sobering Reminder  
Advisor: Adrian Melott, Physics and Astronomy
On 15 February 2013, a small asteroid approximately 18 meters across entered the Earth’s atmosphere and exploded during entry with an energy equivalent to over five and a half Hiroshima bombs. The explosion injured approximately 1500 people: unprecedented for an impact event. The so-called “Chelyabinsk Event” is the largest known asteroid impact since the 1908 Tunguska event. With the event having occurred so recently, rumors and hearsay abound. However, due to the rare and exciting nature of this event, the public is more eager than ever to learn about the science of extraterrestrial impactors and the threats that they pose. By dissecting media reports and newly published papers, this presentation aims to uncover exactly what happened, and what the Chelyabinsk event reveals about our cosmic preparedness.

Kyle Whitaker
Bio-Acoustical Neuromodulation for Fear and Excessive Anxiety Reduction Advisor: Evangelia Chrysikou, Psychology

Recent research on reconsolidating of fearful memories in PTSD sufferers has identified various methods of reducing fear reactivity, including theta pulse stimulation in rat brains found to reverse long-term potentiation. The aim of this study was to investigate whether acoustical stimulation in human subjects could assuage fear reactivity to the recall of fearful memories as measured by heart rate (BPM), electrodermal response (EDR) and self-reported fear, anxiety, and stress. Twenty-one college undergraduates participated. After baseline measurements, participants were asked to think of their most fear-provoking scenario while being administered one of three Bio-Acoustical Utilization Device (BAUD) conditions; a pre-set theta frequency, a frequency of their own choosing, or a white noise “sham” condition. Post-intervention interviews were conducted intending to provoke arousal of the putative fear in the subjects while measurements were undertaken for comparison between groups. Results found promising trends for the set theta condition, producing the lowest physiological reactivity after intervention and greatest decrease in self-report measurements. Although no statistical significance was present, preliminary evidence was supportive of the hypotheses. Implications suggest future research on effects of acoustical stimulation in a theta frequency for phobic populations.

Margaret Witzke
Sitayana Gonna Say Something?
Advisor: Hamsa Stainton, Religious Studies

In 1967, Amar Chitra Katha began telling the children of India (and the world) their tales from the Bhagavad Gita and other religious texts, as well as those from their history through comic books. Suddenly a formerly mysterious culture to outsiders could become as familiar as Superman.

One of the most prominent female protagonists from these stories is Sita. In the Ramayana, Sita is kidnapped and her husband, Rama, must go to find her, with the help of faithful servants. Once
all are returned safely to Rama's kingdom, some in the court start whispering about Sita's faithfulness to her husband while she was captured. To prove her loyalty, Sita walks through fire, unscathed because of her purity. The nay-sayers are still not satisfied and send Sita away, where she gives birth to and raises her and Rama's twins. They eventually come back into Rama's court, but Sita seeks refuge with the Goddess of the Earth and is swallowed thusly. This paper recognizes some common feminine tropes seen in the Ramayana, compares the different ways the story is told (especially in Amar Chitra Katha’s comic books) in India, and compares the representation of females to American comic books’. Despite the fact that Sita is a perfect “damsel in distress” and usually seen as the ideal wife and Indian woman, she is also seen in India as being an independent woman, who is resisting exploitation, and chooses to be where she is. Comic book heroines in America are also put into a similar box, becoming the damsel in distress, while also being hyper-sexualized, to become a similar, submissive “ideal woman.” And while the paper does recognize the significant cultural differences, including comparing a goddess to an entirely fictional character, the similarities and alternate interpretations of these stories show how the local women of both cultures resist the typical exploitative interpretations to find a way to relate to these tales.

Kel Woods
Echoes Through the Haze
Advisor: Megan Kaminski, English

My poetry is an exploration of my own spirituality. My writing is rooted within the themes of the nocturnal and cognitive thinking which harmonizes the experiences of the mundane. Through the use of naturalistic elements I question the visual construction of our world, ultimately seeking an inner truth not only for myself, but in hopes that my audience can begin to explore their own gravitation in this world. I am interested in impressionistic, ephemeral moments in time where the past, present and future blend. Time and memory breathe an important role in the realm of my poetics. By challenging the division between memory and experience, I find that such movement reveals an inherent desire that reflects our own vulnerabilities. My pieces manifest as surreal images in which imagination and reality fuse. By applying a poetic and often lyrical language, I echo the consciousness of the viewer. Furthermore, I create compositions that induce tranquil images that balance the thin veil of recognition and withdrawal.

William Wright
Bio-Acoustical Neuromodulation for Fear and Excessive Anxiety Reduction
Advisor: Evangelia Chrysikou, Psychology

Recent research on reconsolidating of fearful memories in PTSD sufferers has identified various methods of reducing fear reactivity, including theta pulse stimulation in rat brains found to reverse long-term potentiation. The aim of this study was to investigate whether acoustical stimulation in human subjects could assuage fear reactivity to the recall of fearful memories as measured
by heart rate (BPM), electrodermal response (EDR) and self-reported fear, anxiety, and stress. Twenty-one college undergraduates participated. After baseline measurements, participants were asked to think of their most fear-provoking scenario while being administered one of three Bio-Acoustical Utilization Device (BAUD) conditions; a pre-set theta frequency, a frequency of their own choosing, or a white noise “sham” condition. Post-intervention interviews were conducted intending to provoke arousal of the putative fear in the subjects while measurements were undertaken for comparison between groups. Results found promising trends for the set theta condition, producing the lowest physiological reactivity after intervention and greatest decrease in self-report measurements. Although no statistical significance was present, preliminary evidence was supportive of the hypotheses. Implications suggest future research on effects of acoustical stimulation in a theta frequency for phobic populations.

William Wright
The Effects of Stress-related Noradrenergic Changes on Attentional Selection and Flexible Thought
Advisor: Evangelia Chrysikou, Psychology

Research on the neurobehavioral effects of acute stress has shown a shift in brain activity in the presence of stressors, which is thought to reflect a reallocation of resources toward functions that can promote survival. The aim of the present study was to expand on past literature by examining whether the modulation of noradrenergic pathways during stress-related situations in humans affects the reallocation (or narrowing) of attention at the possible expense of flexible thinking. In a between-subjects design, participants were exposed to either a fear-related or an aversive video clip or to one of two neutral video clips matched with the experimental videos for audiovisual characteristics. Stress responses were measured by changes in subjective affect, heart rate, salivary cortisol, and alpha-amylase levels after participants viewed the brief video clips. Following the stress-related manipulation, participants were administered a task associated with creative thought (the Remote Associates Task), which requires flexible access to conceptual networks in memory. Participants were also administered a task of attentional selection (the Neisser task). The order of the tasks was counterbalanced. Measures of individual differences attributed to cognitive, personality, and emotional factors, including susceptibility to anxiety, were also collected. Analyses of performance on the cognitive measures revealed dissociable effects of the different kinds of stressors on attention and breadth of access of semantic memory. These results extend past literature by suggesting possible tradeoffs between attentional focus and flexible thought in the presence of acute stress that can have consequences for performance in real life circumstances.

Julia Yang
Estimating populations of Osha, *Ligusticum porteri*, an important medicinal plant of the Southwest U.S.
Advisor: Kelly Kindscher, Environmental Studies

Osha is an ethnobotanically important medicinal plant whose odiferous roots are currently wild harvested by individuals and herbal-product companies to treat influenza, bronchitis, and sore throat. Our project was the initiation of a multi-year manipulative field experiment to determine acceptable thresholds of harvest intensity that allow for regeneration and sustainable harvest of natural *Ligusticum porteri* populations. One objective was to determine population density for the wider region by creating polygons around the perimeters of geographically distinguished populations and sampling vegetative cover within. We created a total of 8 polygons around a cumulative area of 507,597 m², with an average of 7.8% osha cover. Another objective was to analyze osha’s resistance to harvest by setting up experimental plots in both a meadow site with high light availability, and in a forested site with significant canopy cover. At each of the sites we established 40 replicate 30 m² plots, collected data on the vegetative cover within, and proceeded to harvest roots at variable intensities. There were 15% more plants growing and 58% more kg of root in the Meadow than in the Forested site. We then estimated the weight of root that would be present in our polygons or any given unit area. A population that exhibits a 10% cover will have on average .0349 kg dried root weight per 1 m² area (around 311 lbs/acre). Baseline data was successfully gathered and subsequent years work will involve monitoring regrowth of harvested plots. These data can determine what conservation measures may ensure the long-term viability of this species.

Jackson Young
X-Ray Studies Of The Pixel Readout For The CMS Detector
Advisor: Alice Bean, Physics and Astronomy

In 2016 the Compact Muon Solenoid experiment at the Large Hadron Collider will be upgrading its tracker detector. The tracker, responsible for tracing the trajectory of emerging post-collision particles, has a silicon pixel detector at its core. The silicon sensors are instrumented with custom integrated readout chips (ROC’s). The upgrade will replace the current 3 layers with 4 layers of entirely new silicon pixel detectors. At the University of Kansas tests are being conducted on the newly designed sensor/ROC detectors for the upgrade using X-Ray beams which simulate incoming particles from the LHC’s collisions. Results from energy calibrations, data throughput rate, and efficiency measurements are presented.

Mohan Zhang
Automated Microfluidic Femtoliter Array for Quantitative ELISA at the Attomolar Level
Advisor: Yong Zeng, Chemistry

Quantitative detection of low abundant proteins is of significant interest for biological and clinical applications, such as early diagnosis of disease, point-of-care diagnostics, assessment of treatment efficacy, and monitoring of disease recurrence. We have developed
an automated microfluidic femtoliter array platform that enables ultrasensitive and quantitative enzyme-linked immunosorbent assay (ELISA). The multi-layer microfluidic device integrates pneumatically controlled valves for programmable fluid delivery to improve multistep sandwich immunoassay on the antibody-functionalized substrate surface. A chemifluorescence detection method using an actutable femtoliter microwell array was developed to significantly improve the sensitivity and speed of ELISA. Using insulin-like growth factor 1 receptor (IGF-1R) as the model, we demonstrated that this novel microfluidic ELISA method afford quantitative detection of IGF-1R across four orders of magnitude with a limit of detection (LOD) of 3.5 fg/mL (10.9 aM). Compared with current commercial ELISA kits, our method increases the detection sensitivity by at least three orders of magnitude and reduces the assay time by about one order of magnitude, providing a superior means for quantitative measurement of low-level biomarkers. The microfluidic architecture developed here is easily scalable to achieve high-throughput, multiplexed proteomic analysis with ultrahigh sensitivity.

Amy Zheng
Surface Wave Propagation
Advisor: Dave Besson, Physics and Astronomy

The objective of this research project was to identify the characteristics of surface waves. Ultra high energy neutrinos (UHE) emit charged particles when they hit a dense electrical insulator. These charged particles emit a cone of radiation. When the wavelengths of the radiation are aligned constructively, it is called the Askaryan effect. Some waves are trapped in the space in between the insulator and air are referred to as surface waves. There is scientific evidence that surface waves are more efficient than bulk waves that are currently used. Surface waves are believed to be more resistant to absorption which makes them easier to detect. Surface waves reside on the superficial layer, eliminating the need for drilling. In this experiment, two types of measurements were recorded: attenuation and refractive index. The attenuation measurements determined how easily the surface waves would be absorbed while the refractive index measurements determined how quickly the waves would travel. Observations were made of waves propagating through the surfaces of various dense dielectric media including sand, deionized water, rock salt, and salt at frequencies of 275, 600, 750, 1000, and 1500 MHz. Initially, we ran small scale, near field measurements and the surface waves appeared to travel less than the speed of light. The index of refraction of the surface was between air and the index of refraction of the material. However, once we changed to the larger far-field experiment, the surface waves had a index of refraction of an average of the air and bulk measurements.
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