

# College of Arts and Sciences

## Department of Anthropology, Forensic Science and Archaeology

**Alyssa Brooke Bonorden**

**Faculty Mentor: Carol Macaulay-Jameson**

Macrobotanical Analysis of Carbonized Plant Remains from a Central Texas Rockshelter (41CV1646)

Excavations conducted this summer by the Baylor University Archaeological Field School at a central Texas rockshelter (41CV1646) uncovered a small hearth feature, consisting of tightly-clustered rock, oxidized soil, ash and charcoal. This discovery later became the muse of a macro-botanical investigation into the availability of plant resources of the prehistoric peoples who once inhabited the rockshelter. Soil samples collected from each unit/level were subsequently subjected to the process of flotation. Of 59 samples floated, 35 were chosen for analysis. These samples were sent to Dr. Leslie Bush for analysis, with the intention of 1) reconstructing the plant community within the vicinity of the rockshelter during its prehistoric occupation, and 2) identifying the carbonized macro-botanical remains within the hearth, in order to become knowledgeable about the resources available to the inhabitants for both fuel and food. From this, the question becomes, Why were these plants favored over others which were available? This analysis will attempt to answer this question and in the process of doing so, information about the paleoclimate and seasonal occupation of the site may also come to light.

**Alexis Casiano**

**Faculty Mentor: Carol Macaulay-Jameson**

An Overview of Baylor University's First Field Season at Barnhill Rockshelter #3 (41CV1646) in Coryell County, Texas

This presentation provides an overview of the excavation activities conducted by the 2011 Baylor University Archaeological Field School at Barnhill Rockshelter #3 (41CV1646) in Coryell County. We focused primarily on the upper deposits and completed a total of 24 1x1 meter units and 68 levels. A Late Prehistoric living surface was encountered, consisting of four features and associated artifacts and faunal remains. A team of Baylor geologists visited the site and extracted a soil monolith for micro-morphological analysis. Thirty-five soil samples were collected for flotation and the macro-botanical remains were submitted for analysis. We recovered over 2,500 bone, 18,000 lithic flakes, 2,000 Rabdotus snail shell and 170 stone tools. Future excavations at the site are planned to further expose the living surface, and investigate two earth ovens and a small hearth encountered this summer.

**John Michael Cavazos and Miranda Leddy**

**Faculty Mentor: Carol Macaulay-Jameson**

Utilization of Local and Nonlocal Chert at Barnhill Rockshelter #3 (41CV1646), Coryell County, Texas

The 2011 Baylor University Archaeological Field School was held at a rockshelter on the Barnhill Ranch in Coryell County, Texas. The rockshelter is located along McCutchen Branch, a small tributary of the Leon River. A large outcropping, or quarry, of Edwards Chert was found a few hundred yards above and east of the rockshelter. During excavations, 18,000 lithic flakes were recovered, most of which displayed attributes similar to the chert found at the quarry. Questions were raised as to how much of this local chert vs. nonlocal chert was used by the prehistoric inhabitants of the site. After sorting the assemblage into two categories, local chert and non-local chert, we sorted each group further into size categories in order to discern density patterns across the site. The results of the analysis are presented in our poster.

**Hasan Dimayuga****Faculty Mentor: Dr. Garrett Cook**

Soccer and Mayan Society

Guatemala is increasingly influenced by the forces of globalization. Markovits and Rensman have stated that soccer's most important influences on society are social, political, cultural, and to a lesser extent, economical. It is an international game introduced to the population through Spanish influence. Soccer is a product of globalization in an increasingly neoliberal state. The effects of mass media, religion, and the neoliberal economy not only change Momostecan society, but have also enacted changes that are reflected by the localization of soccer into the meanings of a Mayan society. Ethnographic fieldwork was conducted with the help of the soccer team Santa Isabel and three of its elder members.

**Nathan Fischer****Faculty Mentor: Carol Macaulay-Jameson**

Inventory of the Edible and Medicinal Plant Species Located on the Barnhill Ranch, Coryell County, Texas

Site 41CV1646, a rockshelter on the Barnhill Ranch in Coryell County was the location of the 2011 Baylor University Archaeological Field School. The rockshelter is located along McCutchen Branch, a tributary of the Leon River, and falls within the Lampasas Cut Plain Natural Region. Mr. Barnhill and I conducted a survey of the plant species from two biomes on his property – the riparian woodlands along the drainages and the oak savannah of the uplands. This survey brought to mind questions of which plant species were native to the area as well as how they may have been used by prehistoric peoples. This poster presents a few of the types of native flora on the Barnhill Ranch, and their potential uses by prehistoric groups. Sources used in this project were the United States Department of Agriculture Plant Database, Texas Parks and Wildlife Plant Information Database, and Daniel E. Moerman's Native American Ethnobotany.

**Erica Reynolds and Danielle Schifferdecker****Faculty Mentor: Carol Macaulay-Jameson**

Documenting the Unprovenanced Lithic Artifact Collection from Barnhill Rockshelter #3 (41CV1646), Coryell County, Texas

During the summer of 2011, the Baylor University Archaeological Field School commenced excavation activities at a rockshelter located on John Barnhill's ranch in Coryell County. Prior to our arrival at the site, the Barnhill family had dug a large pit – 7m by 5m in length and 80cm in depth – in the center of the rockshelter and in the process, collected 104 lithic artifacts. Before our excavations began, we cleaned and profiled the walls of the Barnhill excavation pit. From this process, we recovered an additional 27 artifacts. We catalogued, measured, identified and photographed each artifact within these collections. This poster documents the artifacts found by the Barnhill family as well as those recovered from our profiling activities.

**Chris Torres****Faculty Mentor: Carol Macaulay-Jameson**

Analysis of the Lithic Assemblage from the 2011 Baylor University Field School Investigations at Barnhill Rockshelter #3 (41CV1646), Coryell County, Texas

This paper is a synthesis of three studies conducted on the lithic assemblage recovered from excavations at a central Texas rockshelter during the 2011 Baylor University Archaeological Field School. The first study provides an overview of the projectile points and tools, most of which date to the Late Prehistoric Period. The second study reveals areas of tool production within the rockshelter through spatial analysis of debitage and projectile points. The third study presents the results of the analysis of the lithic debitage from one excavation unit. The purpose of this study was to understand the manufacturing technology used by the prehistoric inhabitants of the site.

# Department of Biology

**Jake Abell, Cynthia Estrada, and Kelly Caldwell**

**Faculty Mentor: Dr. Marty Harvill**

Spirogyra, Chara, and Zygnema Nitrogen Uptake

Due to the abundant agricultural run-off, high levels of nitrogen have been found in the Lake Waco Wetlands. This study was conducted to compare the nitrogen fixation rates of Zygnema sp., Spirogyra sp., and Chara sp. Three 5 g samples of each genera were grown with the same amount of Nitrogen in artificial mesocosms. The Nitrogen levels were measured using a HACH DR/890 colorimeter 4 times over a 12 day period of time and analyzed. Results showed that there is no statistical significance between the three genera, but this study shows there is room for further experimentation.

**Sarah Ali, Brandon Allen, Ian Boys, Ariel Cho, Jessica Colunga, Eric Goethe, Ritika Halder, Erin Hegarty, Sara Heyn, Dean Leonard, Richa Manglorkar, Reny Mathew, Kenneth McAdam, Carlyle McGuire, Elizabeth Neumann, Nicholas Neuwald, Anjali Patel, Katelyn Peasley, Katherine Rodriguez, Taylor Scott, Sohun Shah, Ivy Stejskal, Jacob Surges and Christine Wilson**

**Faculty Mentors: Dr. Bryan Gibbon and Dr. Tamarah Adair**

Analysis of the Genome Organization of the F1 Sub-cluster Mycobacterium Phage Dorothy

Bacteriophages are a class of virus specific to bacterial hosts, found in almost any environment, both inside and outside bacterial cells. Mycobacteriophages, in particular, are viruses whose host is one or more Mycobacterium species. They include both temperate and virulent types, and possess relatively small genomes with remarkably high levels of genetic diversity. In the fall of 2011, 24 Baylor Biology students isolated and characterized 24 unique mycobacteriophages from soil samples. One phage was chosen for genomic sequencing (a phage producing lytic plaques named Dorothy). When the DNA sequence was returned, it was analyzed using the bioinformatic tools Glimmer, GeneMark, Apollo, BLAST, and Phamerator to define the potential genes and assign putative function. Dorothy was shown to be of the morphotype Siphoviridae and of subcluster F1. This genome has defined physical ends, and possesses numerous novel genes. Here we report the genomic structure of this mycobacteriophage and describe the probable gene products. Further research into the genomes of bacteriophages may lead to the development of new therapeutics in which phage could be used to kill specific disease-causing antibiotic-resistant bacteria, assist in finding new discoveries in genetics such as using phage to move DNA around for cloning, and providing a useful tool for studying biodiversity and epidemiology.

**Sarah Ali, Brandon Allen, Ian Boys, Ariel Cho, Jessica Colunga, Eric Goethe, Ritika Halder, Erin Hegarty, Sara Heyn, Dean Leonard, Richa Manglorkar, Reny Mathew, Kenneth McAdam, Carlyle McGuire, Elizabeth Neumann, Nicholas Neuwald, Anjali Patel, Katelyn Peasley, Katherine Rodriguez, Taylor Scott, Sohun Shah, Ivy Stejskal, Jacob Surges and Christine Wilson**

**Faculty Mentors: Dr. Bryan Gibbon and Dr. Tamarah Adair**

Isolation and Characterization of 23 Diverse Mycobacteriophage Strains

Bacteriophages are a class of virus specific to bacteria, found in almost any environment, both inside and outside bacterial cells. Mycobacteriophages, in particular, are viruses whose host is one or more Mycobacterium species. They include both temperate and virulent types, and possess relatively small genomes with remarkably high levels of genetic diversity. In this study, we report the isolation and characterization of 23 different mycobacteriophages found by Baylor University students from different geographic locations. Each bacteriophage culture underwent rigorous rounds of purification through titration and plaque screening on plates of infected Mycobacterium smegmatis. Following purification, the phages were characterized by isolating and purifying the DNA, as well as assessing the head and tail size via electron microscopy. The phage DNA was analyzed by restriction digestion using five specific endonucleases and electrophoresed for comparison of its restriction map with those of other known mycobacteriophages and, if possible, assigned to a known cluster. Further research into the genomes of mycobacteriophages may lead to the development of new molecular tools for research or a vaccine or novel treatment against tuberculosis.

**Alexeis Baqui****Faculty Mentor: Dr. Diane Hartman**

Antibiotic Resistance and Sensitivity Patterns in Environmental Isolates of *Edwardsiella tarda*, *Aeromonas* spp., and *Citrobacter freundii*.

Multidrug-resistant pathogens, including a wide array of Gram negative bacteria, are a common threat faced by many hospitals and clinics countrywide. The study aims to define antibiotic resistance patterns of various environmental Gram negative bacteria classified under the Enterobacteriaceae or Vibrionaceae family. All isolates are classified to genus or species using a battery of biochemical assays before the antibiogram. Isolates tested include environmental cultures of *Edwardsiella tarda*, *Aeromonas* spp., and *Citrobacter freundii*. ATCC strains of *Pseudomonas aeruginosa* and *Escherichia coli* are used as comparative controls. Experimental samples are tested in duplicates against six antibiotics of interest: gentamicin, ciprofloxacin, doxycycline, trimethoprim/sulfamethoxazole, neomycin, and amikacin. Isolates are initially cultured on tryptic soy agar (TSA) library plates. Cultures are then transferred to nutrient broth and swabbed to Mueller-Hinton (MH) agar prior to placement of antibiotic discs. The antibiotic plates are incubated at 34°C for 24 hours. The diameter of each zone of inhibition is recorded in millimeters. Preliminary results indicate that all *Edwardsiella tarda* and *Citrobacter freundii* isolates were sensitive to the size antibiotics tested. *Aeromonas* cultures varied in that over half of the samples tested were resistant to the trimethoprim/sulfamethoxazole and sensitive to the remaining 5 antibiotics.

**Emily Biller and Tracey Tran****Faculty Mentor: Dr. Marty Harvill**

Varying Nitrogen Fertilizer Amounts on *Spirogyra* sp. in Lake Waco Wetlands

As the amount of nitrogenous pollution increases in our waterways, it becomes more difficult for aquatic organisms to respire due to the overgrowth of aquatic plants, such as *Spirogyra* sp., consuming the dissolved oxygen in water as they decompose. The experiment included adding increasing amounts of fertilizer to five groups of containers. Based on research, it was hypothesized that a certain amount of fertilizer will start to become harmful to the *Spirogyra* sp., and the dissolved oxygen levels and pH will decrease. The results indicated the amount of fertilizer was at too high of a level to determine the optimal nitrogen absorption. With a limited amount of carbon dioxide, both the dissolved oxygen and pH increased up until week 3, and then had a significant drop on week 4.

**D'Lyssa Bush****Faculty Mentor: Dr. Marty Harvill**

The Effects of Soil pH on *Pontederia Cordata* at Lake Waco Wetlands

The objective of this experiment was to find out how pH affected *Pontederia cordata* (Pickerelweed) growth. Pickerelweed plants were uprooted and taken from Lake Waco Wetlands and then transferred into six mesocosms. The pH was adjusted to three different levels, a specific pH per mesocosm. The three different pH levels measured at a pH of 6, 7 and 8. The pH was measured and adjusted each week to maintain the mesocosm's controlled environment. Along with measuring the pH level weekly, the average number of leaves and leaf lengths were noted. Each week, measurements were graphed, in which it was seen that certain pH environments were more favorable for optimum growth. This showed an important relationship between pH and *Pontederia cordata* growth that would require further testing for accuracy.

**Shannon Carter****Faculty Mentor: Dr. Marty Harvill**

The Effects of Different Nitrogen Levels on *Spirogyra* sp.

The objective of this experiment was to find out how different levels of nitrogen affect the growth of algae. Twelve containers were set up at 4 different levels of nitrogen (0.0%, 0.001%, 0.01%, 0.1%) with 3 trials of each level. At the beginning of the study, 0.5 g samples of *Spirogyra* sp. were collected from Lake Brazos and added to each container. Each week, the mass of the *Spirogyra* sp. was measured to determine the level of nitrogen that promoted the most algal growth. At the end of the three week period there was a significant difference in mass between 0% and 0.1% levels. The effect of the 0.001% and 0.01% levels was more difficult to distinguish.

**Alix Chen****Faculty Mentor: Dr. Richard Duhrkopf**

The Effect of Contact with ORIGIN 3-6-9 in *Aedes Albopictus*

The purpose was to study contact exposure of mosquitoes to ORIGIN 3-6-9. Filter paper pieces saturated with various concentrations of the chemical were put at the bottom of small cages of newly emerged adult *Aedes albopictus*. There were significant differences between the control and experimental groups. Adults coming into contact with the solution died within minutes. The data confirm that the product is a potentially effective contact poison.

**Tamanie Eller, Stephanie Simcox Thompson, John Nathan and Brenna Albracht****Faculty Mentor: Dr. Marcie Moehnke**

Evaluation of the Protective Effects of Acai Berry Against UVB Radiation in *Drosophila Melanogaster*

UVB radiation is known to elicit DNA damage that can result in forms of skin cancer. Antioxidants have been shown to have a protective role against such damage by aiding in DNA repair mechanisms that are elicited in response to DNA damage. The aim of this study is to determine if a popular supplement, acai berry, marketed to the general public as an antioxidant, has the ability to prevent or repair mutations induced by UVB radiation. In this study, *Drosophila melanogaster*, the fruit fly, were exposed to UVB radiation, and the genotoxic effects were measured quantitatively. Then flies were raised in the presence of the mutagen and acai berry to determine if there was a reduction in DNA damage. DNA damage was analyzed using the Somatic Mutation and Recombination Test, or SMART, which has the potential to detect specific types of mutations such as point mutations, nucleotide deletions, and mitotic recombination.

**Greg Fox****Faculty Mentor: Dr. Tamarah Adair**

Investigating Synergy between Antibiotic Treatment and Blue Light Irradiation in the In-Vitro Inhibition of *Staphylococcus Aureus*

*Staphylococcus aureus* is a Gram-positive pathogen—responsible for significant infection rates in both the hospital and the community—whose adaptability, ubiquity, and diverse reservoir of antibiotic resistance determinants have necessitated significantly heightened levels of research in recent years. Especially given the bacteria's ability to form highly resistant biofilms on medical catheters and implants, a number of previous studies have focused on the effects of inhibitory disruptors and methods outside of more standard antibiotic treatment. One such method, blue light irradiation, has seen considerable *in vivo* success in this regard, demonstrating high kill rates with no discernible resistance accumulation in subsequent generations. As other experiments have shown, certain novel treatments can have synergistic inhibitory effects when combined with antibiotic therapy, increasing bacteriocidal efficacy while reducing the likelihood of resistance induction. This experiment was conducted to search for similar synergistic effects when blue light irradiation is used in combination with antibiotic treatments of oxacillin, neomycin, ciprofloxacin, or erythromycin, as observed through changes in MIC and MBC of resistant *S. aureus* strains during broth microdilution testing.

**Kayla Fricke****Faculty Mentor: Dr. Tamarah Adair****The Effects of Blue Light on the Biofilm Formation of Staphylococcus Aureus**

The formation of biofilm complicates the treatment of Staphylococcus aureus infections because antibiotics are unable to penetrate the cells. The use of blue light is being investigated as an antimicrobial agent and treatment, and has been shown to be effective against Staphylococcus aureus in planktonic culture. This experiment has a two-fold objective. The first objective was to measure the effects of blue light exposure on biofilm formation before a 48 hour growth period. The second objective was to measure the effects of blue light exposure on biofilm formation after a 48 hour growth period. This experiment measured the variance in biofilm formation in assorted Staphylococcus aureus strains that were isolated from healthy carriers and exposed to blue light. Cultures were grown in a sterile 24-well microtiter plate, and a biofilm assay was completed after subsequent exposure to blue light. The plates were washed with deionized water followed by an ethanol fixation step, stained for 10 minutes with crystal violet, and solubilized with acetic acid. The amount of biofilm was measured at an absorbance of 540 nm on the Biotek Microtiter Plate Reader. Initial results reveal that biofilm formation varies among strains, with a range between 0.05 and 4.22 optical densities. The results demonstrate that exposure to blue light before a 48 hour growth period inhibits biofilm formation for most strains and that exposure to blue light after a 48 hour growth period does not disrupt biofilm formation. Future studies will test the mechanism of blue light exposure in relation to the formation of these biofilms. If it is proven that blue light inhibits biofilm formation in Staphylococcus aureus, then it has the potential to serve as a preventative for infections in a clinical setting.

**Natasha Gambhir, Sheena John and Oddie Moghalu****Faculty Mentor: Dr. Marty Harvill****The Effect of Potassium Nitrate and Ammonium Chloride on the Growth of Fresh Water Algae in the Waco Wetlands**

The purpose of this experiment is to compare the intake of two different nitrogen sources, KNO<sub>3</sub> and NH<sub>4</sub>Cl, in the two most abundant algae species to find the optimal concentration and variation between the two species. Two species of algae, Spirogyra sp. and Zygnema sp., were obtained and grown in three different concentrations of KNO<sub>3</sub> and NH<sub>4</sub>Cl respectively. The mass of algae was initially recorded and then recorded every other day for 14 days. Growth was observed in the first two concentrations of KNO<sub>3</sub> for both Zygnema sp. and Spirogyrasp. However, although Zygnema sp. exhibited little growth in the first concentration of NH<sub>4</sub>Cl, Spirogyra sp. showed no growth at all. Although there is not enough data to prove that KNO<sub>3</sub> is the direct cause of its growth rate, this study shows that the presence of KNO<sub>3</sub> in fresh water bodies can be beneficial to the growth of algae.

**Simarjeet Grewal****Faculty Mentor: Dr. Diane Hartman****The Examination of Sex and Weight of Turtles in Correlation to the Number and Type of Isolated Microbes**

Turtles were “captured” in Waco Creek from September 12 – October 30 2011. Cloacal swabs were collected from 19 turtles. Swabs were placed in sterile nutrient broth and allowed to incubate for one hour. The swabs were removed aseptically. The broth was then used to inoculate tryptic soy agar and selective agar plates to determine the total number of microbes, gram positive organisms, and gram negative organisms. Gram negative organisms were further divided by the ability to ferment lactose and to produce hydrogen sulfide. The link between the turtle’s sex, weight, and number and type of isolated microbes was examined to determine if there was a distinguishable difference/pattern. The heaviest male and female turtles harbored the fewest culturable microbes. Alternatively, the largest juvenile turtle harbored the most culturable bacteria. The pattern observed from the collected data suggests there is some correlation between the sex of a turtle and whether it is juvenile or adult, and the number of microbes, gram positive organisms and negative organisms that can be found.

**Carson Hoffmann**

**Faculty Mentor: Dr. Marty Harvill**

Sustainable Pharmacology

There has been an increase in awareness of the effects of APIs (active pharmaceutical ingredients). Seventy-five crayfish were used to test the effects of hydrogen peroxide. The results show that the death ratio is directly proportional to the chemical concentration.

**Rachel Elaine Johnson**

**Faculty Mentor: Dr. Tamarah Adair**

Genomic Investigation of Staphylococcus Aureus Photoreceptors

As more bacterial genomic data is gathered, information that promotes a greater understanding of the mechanisms by which these organisms live, adapt, and respond to various stimuli comes to light. *S. aureus* has been shown to be sensitive to blue light irradiation to varying degrees depending on the strain and level of exposure. Other organisms have been found to possess photoreceptors that allow for rapid response to changing environmental factors. However, little is known about the role of photoreceptors in *S. aureus*. This leads to the following two questions: What genomic domains in *S. aureus* contain the coding for these photoreceptors? And can these domains be identified by searching for homologies in other bacterial species? This project tests the hypothesis that the core staph aureus genome contains genetic elements with homologies to known photoreceptors. Based on early results, the genomic domain BLUF FAD that encodes photosensitive proteins in *S. aureus* can be identified through comparison of the staph genome to known sequences of photoreceptors found in other bacterial species.

**Thomas Johnson, Holland Korbitz and Abby Forbes**

**Faculty Mentor: Dr. Marty Harvill**

Effects of Different Fertilizers on Algal Development

This experiment is designed to observe the effects of different concentrations of fertilizers on algae samples. Each fertilizer used is either balanced in nitrogen, phosphorous, and potassium, or contains a majority in one of those categories. Four grams of algae is added to each of the 15 containers and 10 mL of fertilizer solution is added to each container. At the end of a twelve day period the algae was removed and filtered and weighed. The results showed that the phosphorous rich fertilizer caused the most growth, while the nitrogen and potassium based fertilizers did not provide sufficient nutrients to keep the algae living. This was observable in the color changes between the different fertilizers as well. In conclusion this demonstrates that phosphorous in fertilizer causes the most growth and is detrimental to the environment in large concentrations.

**Dana Larsen**

**Faculty Mentor: Dr. Marty Harvill**

The Consequences of Point Mutations on Von Willebrand Factor Protein Expression and Binding

Von Willebrand's Disease (VWD) is one of the most prevalent genetic bleeding disorders and is characterized by a decrease in quantity or functioning ability of the Von Willebrand Factor (VWF) protein which circulates in the blood plasma. Specifically, type 2M VWD presents with normal amounts of VWF, but a decrease in the protein's ability to bind platelets, and frequently collagen, effectively. In this project, four new mutations all corresponding to patients diagnosed with type 2M VWD were analyzed through several types of assays to determine their binding capabilities compared to the wild type protein and accepted standards. Transfecting pCIneo vectors with the mutated VWF protein sequence into HEK293T cells and harvesting both the supernatant and the lysate, enzyme-linked immunosorbent assays (ELISA's) were performed on all of the supernatants using standard protocols. ELISA's were performed to determine the amount of protein in the supernatant and the lysate, the protein's ability to bind to human collagen types I, III, and VI and its interaction with human platelet glycoprotein Ib- $\alpha$  (GPIb- $\alpha$ ) directly and indirectly through the use of the antibiotic ristocetin. It was found that all four mutations had reduced or no binding at all to GPIb- $\alpha$  while just two of the mutations lacked binding capabilities with ristocetin; these results were characteristic of type 2M diagnoses. One mutation, however, located at a hinge-point on the crystallized structure of the A1 domain of VWF, was determined to have decreased binding with all three types of collagen. Another mutation lacked binding to specifically type VI collagen. These results suggest specific locations where the presence of the wild type amino acid is imperative for proper protein binding and functioning, and may be used for better diagnosis and treatment of type 2M VWD.

**Cassandra Maier, Lauren Brubaker, and Kaitlin Skelly**

**Faculty Mentor: Dr. Marty Harvill**

Effects of Varying Levels of Nitrogen on Spirogyra sp. Growth

The purpose of this project was to detect the optimal level of nitrogen suitable for algae growth. The method of measuring growth was calculating the mass of the collected Spirogyra sp. culture once a week. There were twelve containers: four of which were controls (no added nitrogen), four were filled with 2% nitrogen, and four were filled with 7% nitrogen. Five mL of the two fertilizers were added to each of the four designated containers. 0.3g of algae was added to each container as a beginning mass. After seven days, the Spirogyra sp. growth was measured by filtering the water from the containers and catching the algae in filter paper. The filter paper and Spirogyra sp. were weighed on a digital scale. Later the weight of the filter paper was subtracted. It was expected that the 2% nitrogen fertilizer would produce optimal algae growth. The results confirmed that 2% nitrogen produced the optimal growth for the Spirogyra sp. culture.

**Arushah M. Manasia, Tony Nguyen and Emily Scannapieco**

**Faculty Mentor: Dr. Marty Harvill**

Arsenic Content in the Soil of Waco Wetlands

Arsenic is naturally found in wetlands soil due to natural activities such as rock erosion and forest fires. We wanted to test the effect of plants on the quantity of arsenic in the soil throughout the Waco Wetlands. We hypothesized that cell one would have the highest levels, while cell five would have the lowest. We collected 20 samples, and using a revised procedure from our arsenic kit we produced comparable results of arsenic levels within each cell, both by and away from plants. The arsenic levels in the wetlands showed a U-shape, with cell one and five having the highest levels and cell three having the lowest.



**Carlo Manzana**

**Faculty Mentor: Dr. Tamarah Adair**

The Induction, Purification and Host Range of 4 Lysogenic Phages

Bacteriophage therapy has resurfaced as a potential treatment option against *Staphylococcus aureus* due to the recent increase in antibiotic resistance. One source of isolating bacteriophages is through phage induction, a process in which a prophage is excised from its lysogenized state. This experiment induced, purified, and determined the host range against 64 *S. aureus* isolates for 4 bacteriophages. To induce the phages, Mitomycin C was added to 58 *S. aureus* cultures and the product phage solutions were then spotted onto a panel of 10 different isolates to test for lysis. Forty of the fifty eight solutions tested positive for phages. Of these phages, the 15 most lytic, to the panel of 10 isolates, were chosen to be purified but only 4 were purified through 4-5 rounds of successive purification. Phage stocks were produced and a plaque assay was performed to determine the phage concentration. These phages (labeled 2734, 346, 349, and 2069) were then assayed for their host range. 2734 exhibited the widest host range, lysing 10 of 64 isolates through the spot test. While the phages induced in this experiment manifest lytic ability, their host ranges are not as extensive as phage K, a well-known phage that lysed 55 of 64 isolates in this study. This experiment determined that although lysogenized phages can be a source for phage therapy, most of these phages display low levels of lytic activity.

**Prachi Mohile and Kayla Vaughn**

**Faculty Mentor: Dr. Marty Harvill**

The Effects of *Nymphaea* sp. Extract on *Daphnia* sp. Movement

It has been observed that, in some cases, chemicals released by aquatic macrophytes upon experiencing tissue damage can be harmful to zooplankton inhabiting the area. In particular, water lily is believed to have negative effects on zooplankton. This experiment was designed to test the effects that *Nymphaea* sp. extract has on the movement of *Daphnia* sp. The hypothesis that *Daphnia* sp. would move away from the water lily extract was rejected. No significant net movement away from the plant extract was observed in the water lily trials, and the water lily trials did not differ significantly from the controls.

**Lauren Nager and Jacob Moran**

**Faculty Mentor: Dr. Marty Harvill**

Comparing the Effects of EcoExempt and Chemical Permethrin on *Spirogyra*

The principal objective of the experiment was to view the effects of pesticides, chemical permethrin and eco-friendly EcoExempt, based on plant life in the wetlands. In order to test the hypothesis, controlled environments were set up in the lab that contained measured amounts of algae, water, and different concentrations of pesticides. After the environments sat for a week, the algae was taken out and measured in comparison to the initial values. It was found that the algae in the permethrin solutions had a decreasing mortality rate as the concentration level grew. In the EcoExempt solutions, the mortality rate remained relatively constant for each concentration. The conclusion for the permethrin solutions was that the nitrogen present in the permethrin molecules promoted plant growth. The conclusion for the EcoExempt is that it has no effect on the algae at all, because it neither promoted nor demoted plant growth.

**Suk Namkung****Faculty Mentor: Dr. Tamarah Adair**

## Phage K Infectivity of Staphylococcus Aureus Isolated from Healthy Carriers

Bacteriophage therapy is one alternative to antibiotics that is gaining attention due to the increasing resistance of Staphylococcus aureus to antibiotics. Bacteriophages are known to have a narrow host range, which limits the side effects that often accompany antibiotics. However, due to the large amount of genetic diversity found between S.aureus strains, the single-phage therapy approach may not be suitable to treat all strains of S.aureus. The objective of this experiment was to test the infectivity of bacteriophage K, a well-studied Staphylococcal phage in the Myoviridae family, against 100 isolates of S. aureus previously collected from the anterior nares of healthy carriers at Baylor University. In order to screen a large number of strains, we developed a spot assay using overnight S. aureus broth cultures, mixed with top agar, and transferred to 24 well plates containing an agar base. Phage K solution was then spotted on top of the S.aureus bacterial lawn and incubated overnight. The results from this experiment found that 63% of total isolates were killed by the phage K, but only 39 % of the methicillin resistant isolates were killed. Therefore, future investigations are needed to understand the mechanism of phage resistance.

**Sandy Nguyen and Victor Manon****Faculty Mentor: Dr. Marty Harvill**

## Nitrogen and Phosphorus Effects on Algal Growth in Various Locations

The purpose of this experiment is to see the effects of nitrogen and phosphorus on the growth of green algae of various locations in the Waco Wetlands. The experiment was conducted by isolating and placing the green algae, Spirogyra sp., in three artificial, controlled environments each filled with water from different locations in the wetlands. Specifically, this experiment tested the initial levels of Phosphorous and Nitrogen found within locations one, two, and four, and the nutrients' effects on the growth of Spirogyra sp. over a two week period. Each week, measurements of the nitrogen and phosphorus were taken and the mass of the algae was measured. Phosphorous and nitrogen are limiting nutrients essential for greater algal growth and consequentially, greater depletion of environmental phosphorous and nitrogen in location one. Although the hypothesis was proved wrong, data was collected that proved the critical importance of nitrogen and phosphorous to algal growth.

**Stephanie Nguyen****Faculty Mentor: Dr. Marty Harvill**

## Fluoride Toxicity in Crayfish

Fluoride is routinely added into municipal water to promote dental health and is not filtered out (Miller-Ihli, 2003). High concentrations of fluoride are known to kill invertebrates by affecting organisms' growth. Mortality depends on exposure length and water temperatures (Camargo, 2003). The limits of fluoride toxicity in crayfish were studied in order to determine the concentration at which the fluoride becomes toxic to the crayfish. The objective of the experiment is to determine at what level does fluoride begin affect crayfish mortality. Fluoride was studied because it is a common chemical additive in water. Initially, the crayfish were placed in fluoride concentrations between 0 ppm and 50 ppm in increments of 10 ppm. However, because the entire sample perished within 72 hours, the experiment was refined to concentrations between 0ppm and 20 ppm at increments of 3ppm, and the crayfish were observed for a longer duration. During which time, the percentage of crayfish dead was recorded at each 24 period for 5 days. It was found that fluoride became lethal at 7ppm after a 72 hour exposure. Pass this concentration and time, mortality increased exponentially.

**Lauren Nowacki****Faculty Mentor: Dr. Shapiro (Mayo Clinic, VA, Department of Immunology)**

Effect of Forced Over-Expression of c-kit, MEF2C, and ABCB7 on the Survival of NKAP Knockout Hematopoietic Stem Cells

NKAP is a transcriptional repressor that is essential for hematopoiesis. Upon NKAP deletion from conditional knockout (cKO) mice, hematopoietic stem cell (HSC) proliferation decreases and apoptosis increases. In vitro, HSCs from estrogen receptor(ER)-cre NKAP cKO mice also die upon NKAP deletion. In this inducible system, Tamoxifen causes nuclear translocation of constitutively expressed ER-cre, where it catalyzes deletion of the NKAP gene. The genes c-kit, MEF2C, and ABCB7 are downregulated after NKAP deletion, so we sought to determine if these genes are part of the mechanism by which NKAP regulates HSC survival. Three retroviral expression plasmids were created to ectopically express c-kit, MEF2C, and ABCB7. Next, retroviruses were generated for each gene. Empty retrovirus and NKAP-expressing retrovirus were used as negative and positive controls, respectively. Two days after NKAP ER-cre cKO HSCs were transduced, they were treated with Tamoxifen to induce NKAP deletion. After three more days, the survival of HSCs was quantified by flow cytometry. After NKAP deletion, the cells infected by virus containing NKAP (positive control) were the only group to exhibit increased survival when compared to non-infected cells. This proves the principle of the experiment: the effects of NKAP deletion can be rescued when the functionally crucial gene is retro-virally expressed. Retroviral transduction of c-kit, MEF2C, and ABCB7 did not rescue HSC survival. This may be due to low transduction efficiency, or because more than one gene must be added to restore hematopoietic function. Further investigation will be done with combinations of genes to determine the role of NKAP in hematopoiesis.

**Ogechukwu Obiano****Faculty Mentor: Dr. Marty Harvill**

Color and Orientation Preference of *Procambarus Clarkia*

Color is a key component of vision, and thus the focus of this experiment. In this study, three male *Procambarus clarkii* were collected and observed in the lab for behavioral responses in relation to the colors: red, blue, and yellow. Data was collected for *Procambarus clarkii* responses to the stimuli and there was a tendency for the *Procambarus clarkii* to migrate towards the blue and the right side. These were the expected results because of the color spectrum that they see and the position of the air stone on the right side of the holding tank.

**True Price and Jonathan Powers****Faculty Mentors: Dr. Erich Baker and Dr. Bessie Kebaara**

Identification of *S. Cerevisiae* Genes with Alternative 3'-Processing Sites

The decay of messenger ribonucleic acid (mRNA) is important in the regulation of gene expression. A major pathway in eukaryotic organisms that influences mRNA decay is the nonsense-mediated mRNA decay pathway (NMD), which aids in the detection and rapid degradation of mRNA sequences with premature stop codons. Genes with atypically long 3'untranslated regions (UTRs), arising naturally or through mutation, are typically degraded by the NMD pathway. Additionally, a number of genes undergo alternative 3'-end processing, producing different isoforms of a single mRNA sequence, each with a different 3'UTR length. It is our hypothesis that alternatively 3'-end processed mRNAs with atypically long 3'UTRs are potential NMD substrates. Our ongoing work employs neural network and Bayesian models to classify those *S. cerevisiae* genes which exhibit alternative 3'-end cleavage, based on probabilistic scoring of cleavage-site likelihood developed previously by Graber et al. We then experimentally validate the predicted 3'-end processing patterns using 3' Rapid Amplification of cDNA ends (RACE-PCR). Further research will use our model to investigate the extent to which to which alternatively 3'-end processed genes with long 3'UTRs are degraded by the NMD pathway.

*(Students are majoring in Bioinformatics in the School of Engineering and Computer Science; project was conducted in the Department of Biology.)*

**Meredith Rosenthal****Faculty Mentor: Dr. Tamarah Adair**

## The Effects of Visible Light on Staphylococcus Aureus

Infections due to Staphylococcus aureus are of growing concern in the American healthcare system. The number of outbreaks continues to rise, and strains become more resistant to different antibiotics. Staphylococcus aureus is a Gram-positive cocci bacterium which can cause a range of medical ailments from skin infections to pneumonia and even death; therefore, discovering alternative treatments for Staph infections is of great interest. Photodynamic light therapy is one such alternative treatment which has shown promising results on such skin ailments as acne. The objective of this study was to examine the effects of different wavelengths of light on the standard ATCC strain of Staphylococcus aureus. These results were then compared to previous research involving blue light which has been shown to have significant bactericidal effects on Staphylococcus aureus. For each trial, a culture of ATCC was grown and plated on a microtiter plate in concentrations of  $10^{-4}$ ,  $10^{-5}$ , and  $10^{-6}$ , then subjected to a specific wavelength of light for 2 hours (another row of wells not exposed to light was used as a control). The colors of light used in this study were red, green, yellow, and white, with white light having the greatest effect and red light having no significant effect. The wavelengths used in this study had lesser impacts on the growth of Staphylococcus aureus than did blue light in previous studies, confirming that blue light is the better choice to use in this type of treatment of in vitro Staphylococcus aureus.

**Tina Tran****Faculty Mentor: Dr. Diane Hartman**

## Bacteria Lurking in Waco Creek

The quantification and identification of bacteria is important in environments with high human activity. Knowledge about the bacteria present can help prevent people from acquiring bacterial infections. This study determines the average number of gram positive halophiles and the average number of gram negative organisms in the campus portion of Waco Creek. Water samples were collected from three sites along Waco Creek. Dilutions of 0.1 mL, 0.2 mL, and 0.3 mL were inoculated on the different types of media. Mannitol Salt Agar (MSA) was used to isolate gram positive halophiles, MacConkey's Agar (MAC) was used to isolate gram negative organisms, and the total number of microbes, both gram positive and gram negative, were isolated on Tryptic Soy Agar (TSA). The average total number of organisms collected was 7104 per milliliter. The average number of gram positive halophiles collected over four runs was 196 per milliliter and the average number of gram negative organisms was 2790 per milliliter. Isolates with different characteristics were selected from the samples, transferred to library plates, gram stained, and classified into genus and species using biochemical tests.

**Robin Vander Pol****Faculty Mentor: Dr. Kenneth Wilkins**

## Characteristics of Urban Constructions Occupied by Bats

With increased urbanization, native species are forced to cope with changing environments. Many wildlife species are affected by their new surroundings, however, many species, including some bats, have adapted and possibly even benefited from the change. Certain species of bats have begun to roost in human constructions, occasionally even forgoing a natural one. However, not much research has been done concerning the features of these chosen buildings that attract bats. The purpose of this study is to identify some of these unknown characteristics. Previous research has shown that Tadarida brasiliensis (Mexican free-tail) roosts in many constructions in Waco, Texas. In our research, we surveyed buildings in downtown Waco and identified 62 as being used as roosts. These buildings were identified by the presence of external marks such as guano deposits and bat vocalizations, signaling bat presence. Of the identified roosts, 41 were day roosts and 21 were night roosts, used only as resting positions during the night. Using observation and GIS software, we gathered information on various building attributes (such as human occupancy, building footprint area, distance to nearest forest edge or body of water, light intensity and building material) to determine those characteristics that were most common between bat-occupied sites. In the few previous studies examining human constructed bat roosts, building height and size were determined to be influential. Knowing which features signal roost selection will aid in conservation of bat species.

**Anmol Wadhvani, Katy Rodriguez and Joshua Higgins**

**Faculty Mentor: Dr. Marty Harvill**

Effects of *Typha* sp. on the Growth of *Schoenoplectus Californicus*

Among many mechanisms, invasive plant species utilize strength in numbers to outcompete with native plant species in an environment. The cattail (*Typha* sp.) plant was chosen as the invasive species and the bulrush (*S. californicus*) as the native species because both inhabit Lake Waco Wetlands. To determine how the invasive species affects the growth of the native species, this design observes the change in height, carbon levels, and nitrogen levels in nine mesocosms over the course of three weeks. The groups included two plants of cattail, two plants of bulrush, and one plant of each species per trial. The recorded levels showed little variation among the groups expressing weak to no correlation to invasive effects. Therefore, the research concludes that the influence of invasive plant species is dependent upon the population density ratio between the invasive and native plants and not necessarily physiological aspects that contribute to biological fitness.

**Kristine Williams**

**Faculty Mentor: Dr. Kenneth Wilkins**

Bat Foraging Activity in Response to Different Light Intensities at Twelve Locations on Baylor University Campus

The relationship between bats and urbanization is not yet well understood. However, the relationships between bats and insects, and between insects and light, are independently well-studied. Whereas bats are nocturnal and generally operate in darkness, insects tend to be drawn to illumination at nighttime. For this project, the combination of both relationships is being studied to determine how foraging activity of bats in an urban setting might vary in connection to different levels of artificial lighting and how that relates to densities of prey attracted to illuminated areas. Insects are collected once a week at four of twelve sampling locations using fly paper, and echolocation signals are recorded nightly from 1900 hours to 0700 hours for five consecutive nights using ultrasonic detectors (Wildlife Acoustics). The twelve locations on the Baylor University campus fall into groups of four based on the average nighttime light intensity due to the artificial lighting: low, medium, or high intensity. To analyze the echolocation data, we are utilizing the program SoundScope. We expect to find direct correlations between bat activity (indicated by the number of foraging calls made by bats), light intensity, and the number of insects captured at each site. Our prediction is that bats will be more active in areas with higher light intensities, and that insects will be more abundant in these areas with higher light intensity.

**Lucy Xu**

**Faculty Mentor: Dr. Diane Hartman**

Environmental Isolation of Gram-Negative Bacteria

Turtles can be carriers of bacteria of the genus *Salmonella* and studies have documented *Salmonella* shedding in many captive populations. Shedding of *Salmonella* may be related to contamination of capture facilities and/or health of individual turtles. This study focused on the microbes isolated from a natural environment populated with healthy turtles. Water samples were collected from different sites to determine the prevalence rate of *Salmonella* in the environment. A cohort study examined turtle swabs for microbial analysis. Serial dilutions of water were inoculated on Tryptic Salt Agar (TSA), Mannitol Salt Agar (MSA), *Salmonella/Shigella* (SS) agar, as well as MacConkey's (MAC) agar, spread with a glass hockey stick, and then incubated at 35°C for 24 hours. Colony forming units per mL of water were calculated. Colonies were sorted by hydrogen sulfide producers (black), non-lactose fermenters (tan) and lactose fermenters (pink). Fewer than 1% of the gram negative isolates produced hydrogen sulfide. None were identified as a *Salmonella* organism. The majority of hydrogen sulfide producers being *Edwardsiella tarda*, *Edwardsiella hoshinae*, *Citrobacter freundii*, and *Aeromonas* spp. Gram negative organisms were subdivided by their ability to ferment lactose and fluid thioglycolate results. The predominant culturable microbes were gram negative, facultative anaerobic bacilli that did not ferment lactose. Representatives of this group included *Aeromonas* spp. and *Vibrio* spp.

# Department of Chemistry and Biochemistry

**Morgan Cooper**

**Faculty Mentor: Dr. Mary Lynn Trawick**

HPLC Analysis of the Enzymatic Bioreductive Cleavage of Prodrugs

Most solid tumors in cancer have regions of hypoxia (low oxygen levels). In hypoxic cancer cells, generally a significant increase in bioreductive enzymes such as NADPH(P450) reductase, and DT diaphorase is observed. Thus there is a selective difference in the tumor microenvironment from that of normal tissues. This has led to the development of hypoxia-selective prodrugs designed to release the active compound under hypoxic conditions. Such bioreductive agents are composed of three main parts: a bioreductive trigger, a linker and a cytotoxic effector that becomes highly active once released under hypoxic conditions. In this study, an HPLC assay was used to determine the release of active effector from bioreductive prodrugs using individual enzymes. This is a collaborative project involving the Trawick and Pinney Laboratories.

**Joseph Guillory and Jay Johnson**

**Faculty Mentor: Dr. Mary Lynn Trawick**

Biochemical Evaluation and Molecular Modeling of Thiosemicarbazone Inhibitors of Cruzain

Cruzain is the recombinant form of a powerful cysteine protease found in *Trypanosoma cruzi*, protozoa responsible for the transmission of Chagas' disease. This neglected disease affects millions of people in poor areas in Central and South America. To date, patients can only be treated for the disease in its acute stage, and approved treatments show undesirable side effects. Once a *T. cruzi* infection is established, there is no effective treatment. Cruzain has become a target for the development of new chemotherapeutic agents. A number of compounds with the thiosemicarbazone moiety are potent and inhibitors of cruzain. In a collaborative project with the Pinney Laboratory, KGP94 was shown to be a cruzain inhibitor. Molecular modeling of thiosemicarbazone inhibitors reveals the orientation of the best cruzain inhibitors would promote the formation of a transient covalent bond between the thiosemicarbazone of the inhibitor and the Cys25 thiolate of cruzain.

**Megan Hermann**

**Faculty Mentor: Dr. Sung-Kun Kim**

Highly Potent Inhibitors of Anthrax Metallo- $\beta$ -lactamases by Hydroxamate Functionality

The emergence of drug resistant bacteria by overuse and misuse of antibiotics is a growing problem. The enzymes known as  $\beta$ -lactamases are the main culprit of antibiotic resistance. To date there are no clinically available inhibitors for metallo- $\beta$ -lactamases (MBLs), prompting us to discover effective inhibitors to help combat antibiotic-resistant bacterial infections. A strain of the bacterium *Bacillus anthracis*, the causative agent of anthrax, is capable of producing a MBL, referred to as Bla2. To design inhibitors which target the two zinc ions present in the active site of Bla2, two novel hydroxamic acid-containing compounds were synthesized. Kinetic analysis of the two compounds using penicillin G as a substrate demonstrated reversible, competitive inhibition with  $K_i$  values of  $0.22 \pm 0.08 \mu\text{M}$  and  $0.18 \pm 0.06 \text{nM}$ , the most potent of which possesses two hydroxamic acid functional groups. *In silico* analysis has shown that the hydroxamic acid of these compounds is coordinated with a zinc ion in the active site of enzyme, supporting the competitive inhibition observed experimentally. These observations clearly suggest that these hydroxamic acid-containing compounds may be useful drug candidates and provide insight as to what type of structure modifications may improve effectiveness of enzyme inhibition.

**Taylor Kohn****Faculty Mentor: Dr. Bryan Shaw**

## Identification of Spontaneous and Artificial Deamidation of SOD1

Several diseases, including Alzheimer's and Parkinson's, have been linked to deamidated proteins. While deamidation sites for some proteins have been reported, deamidation is difficult to identify because there is only a 0.984 Da difference between the unmodified and modified state. In this study, we identified the naturally and artificially occurring deamidated residues in superoxide dismutase 1 (SOD1) by using capillary electrophoresis to separate deamidated protein species by their charges and liquid chromatography tandem mass spectrometry (LC-MS/MS) for proteomics. Amyotrophic lateral sclerosis (ALS) is thought to be caused by the aggregation of SOD1 in neurons. Familial ALS is believed to be caused by SOD1 point mutations which have an increased propensity to aggregate. Several of the common point mutations are similar to post-translational deamidation where an aspartic acid residue replaces an asparagine residue; it may be that post-translational deamidation is a cause of sporadic ALS. Additionally, other studies have suggested that post-translational modifications such as oxidation and phosphorylation affect the aggregation propensity of SOD1. Of the seven asparagines in SOD1, two were found to occur in natural conditions. Asparagine residue 26 was found to be deamidated in purchased wild type Cu, Zn-SOD1 purified from human erythrocytes and was found to be the first asparagine residue to deamidate in SOD1 purified from yeast. Asparagine residue 131 was next to deamidate after 30 days in conditions of pH 8.0 at 37°C. This project then studied artificial deamidation caused by the digest conditions. Four asparagines residues (Asp19, Asp26, Asp86, and Asp131) were found to undergo artificial deamidation due to the trypsin digest at pH 7.4 and 37°C. Determining the sites of deamidation will allow future studies to determine if certain sites promote or inhibit aggregation.

**Sunay Patel****Faculty Mentor: Dr. Sung-Kun Kim**

## Selection of ssDNA Aptamers Against Live Escherichia Coli Cells

Aptamers, oligonucleotides that can bind to target molecules with high affinity and specificity, have typically been developed using a technique called SELEX (Systematic Evolution of Ligands by Exponential Enrichment). In this study, ssDNA aptamers specific to the surface of Escherichia coli have been determined using undisturbed live cells through a modified Cell-SELEX procedure. Polymerase chain reaction (PCR) was used to amplify the initial random library and the interaction between magnetic bead-attached streptavidin and biotin-attached ssDNA assisted in the rendering of dsDNA PCR product to use in SELEX rounds. Counter-SELEX rounds using various bacteria such as *C. freundii*, *S. epidermidis*, and *E. aerogenes* were performed to improve specificity. After five rounds of SELEX, a total of fifteen aptamers were successfully identified. Affinity testing was determined by UV quantification of unbound aptamer after incubating aptamers with the live cells. Among the fifteen oligonucleotide sequences, eleven were found to effectively bind to the surface of Escherichia coli with Kd values ranging from 1.5-25  $\mu$ M. These findings may provide a new method for detecting bacteria.

**Victoria Soeung****Faculty Mentor: Dr. Mary Lynn Trawick**

## Biochemical Evaluation of Thiosemicarbazone Compounds for the Treatment of Chagas' Disease

Cruzipain is the major cysteine protease of the parasite *Trypanosoma cruzi* which is the causative agent of Chagas' disease. There is no cure for Chagas' disease once it has been established, and it is a leading cause of cardiomyopathy in Central and South America. *Trypanosoma cruzi* requires cruzipain for survival and replication, including its ability to evade host defensive mechanisms. Cruzipain has been validated as a target for the treatment of Chagas' disease. Through a collaborative project with the Pinney Research Group, the Trawick Laboratory evaluated a small library of functionalized thiosemicarbazones against cruzain, a recombinant form of cruzipain, for inhibition of enzyme activity, and a number of active compounds were found. In this study, an additional series of thiosemicarbazone compounds were evaluated as cruzain inhibitors. A fluorometric microplate assay was utilized to monitor the release of the product, aminomethylcoumarin, from the substrate benzyloxycarbonyl-phenylalanyl-arginyl-aminomethylcoumarin, as a measure of the activity of cruzain. Data were analyzed by Graphpad and IC50 values were determined. IC50 values correspond to the concentration of compound required for inhibition by 50% of the enzyme's activity, and are used to measure the effectiveness of an inhibitor.

# Department of Classics

**David Moore**

**Faculty Mentor: Dr. Julia Hejduk**

Ovidian Influences within Bernardus Silvestris' *Cosmographia*

Whereas Ovid's *Metamorphoses* stands out as one of the most popular and well-researched works of the Classical canon, Bernardus Silvestris' *Cosmographia* has long been one of the more obscure and academically eschewed works from the noted "Twelfth-Century Renaissance". In the *Metamorphoses*, Ovid playfully explores the truth and reality of the human experience, combining natural science with poetry and the scientific with the artistic. The triumph of Ovid's work lies in his ability to balance the discord of the *Metamorphoses*' content with the harmony of its form. Bernardus Silvestris' *Cosmographia* recalls, emulates, and expands upon Ovid's *Metamorphoses* both stylistically as well as thematically. Although Silvestris draws from an impressive variety of both Classical and Medieval sources in the *Cosmographia*, little scholarship exists exploring the various connections between the *Metamorphoses* and *Cosmographia*, despite the resemblance. The form of the *Cosmographia* meets its function as easily and seamlessly as in the *Metamorphoses*, and the facility and subtlety of Silvestris' language and wit both reverently acknowledge the mastery of their Classical predecessor. This paper will seek to explore the many ways in which the *Cosmographia* exhibits the influence of the *Metamorphoses* and to examine how this influence reflects on the poetic model and motivation of each work.

# Department of English

**Amy Heard**

**Faculty Mentor: Dr. Elizabeth Womack**

Public Perception and Poverty: The Importance of Understanding How We Think About the Poor, and How We Can Change Our Misconceptions

American thoughts and attitudes are affected by fact, fiction, and experience. My research explores public perception of the impoverished by explicating academic writing and the popular media, then examining one organization that seeks to change negative perceptions of the impoverished. The first section of my research is a brief literature review of current poverty theory. The academic discussion of poverty includes definition of common terms (such as poverty threshold) as well as a brief discussion of structuralist and individualistic poverty frameworks. In contrast to the academic writing are the reports of the popular media. A brief survey of *The New York Times*, *The Wall Street Journal* and *The Waco Tribune-Herald*, among others, revealed positive and negative trends in the way poverty is presented. This section is especially important to understanding public perception because many people will never read academic papers, but most will read some form of popular media. The final section examines the strengths and weaknesses of a Baylor Campus Kitchen, a student-led hunger alleviation group. The group is presented as an example of a low-cost, high-reward organization that can help reduce negative stereotypes by introducing the middle class to the impoverished without reducing the dignity of the poor. When engaging in any discussion, it is important to know the topic and recognize your biases. This project seeks to encourage everyone to sift through the information and misinformation before casting judgment on those in need.



**Alex Weaver**

**Faculty Mentor: Dr. Clay Butler**

Discourse in a Healthcare Setting

While medical doctors are carefully trained in the science of human biology, the skill of communicating with human patients is often devalued in their training. Patients sometimes come out of a consultation with a doctor confused about the details of the medical diagnosis. This presentation examines audio recordings of clinic visits between doctors and their patients to see if there is a pattern in the conversations that causes some patients to leave an appointment without having all of their concerns addressed. Through analyzing their discourse, I hope to bring insight into the way that meaning is constructed in the exam room, allowing both the doctor and patient to communicate more effectively.

## Department of Environmental Science

**Brian Jonescu, Stephanie Smith, Matthew Fisher, Alaina Hoey**

**Faculty Mentor: Dr. Susan Bratton**

Day Hiking in Urban, Natural or Wilderness Settings: The Type of Hike versus the Environment as Determinants of Hiker Experience

Twenty-five college students participated in over 200 day hikes divided into three types: 1) goal oriented 2) nature study and 3) incorporating prayer or meditation. Hikes occurred in three settings within the deciduous forest biome: urban with human development, natural woods or wetlands, and national park with wilderness management. Analysis via SPSS 17.0 programs utilized procedures: means, crosstabs, general linear models, and nonparametric. Using a 1 through 5 scale from very untrue to very true, hikers responded to 31 statements describing personal experience, experience with nature, and spiritual experience. The type of hike was far more important to the spiritual outcomes, than was the hiking environment. Type of hike had little effect on personal experience, and moderate influence on natural experience. The natural setting, in contrast, had a great effect on natural experience. Both urban and more natural environments, however, contributed to learning about environmental care. The results imply that religious practice, rather than wilderness ambiance or natural beauty, is central to experience of the divine in outdoor experiences of limited duration. The environmental educational quality of a day hike is, however, sensitive to the location.

**Thomas Moore**

**Faculty Mentor: Dr. Larry Lehr**

Biodiesel Alternative Substrate Study (BASS): Determining the Extrapolation of Percent Yields from Small- to Large-Scale Conversion of Various Substrates to Biodiesel

With the price of petroleum fuels continually on the rise, more time and money is being focused on developing alternative forms of energy. Biodiesel is a direct replacement for diesel fuel and can be made from vegetable oils, animal fats, and waste cooking oil. Several area universities are growing various agronomic feedstocks for biodiesel production and testing them on a small-scale. The BASS will be a collaborative venture with other universities in the region to assess experimental agronomic feedstocks for biodiesel production, on a larger than laboratory scale. Assessment will cover both the physical efficiency and economical efficacy of utilizing these feedstocks on a large scale. Large scale conversion assessment is an important component of feasibility assessment for substrate evaluation. The BASS will also provide Baylor University with a service that will collect a waste stream generated on campus and process it into a fuel source. This diesel fuel will replace a significant amount of the fuel that is currently being purchased by the University to run its diesel-operated vehicles. A feasibility study of the University's waste cooking oil and diesel fuel use predict this system saving Baylor around \$10,000 every year. Additionally the BASS will inventory local waste streams around the Waco area. If waste streams in the area are viable for biodiesel production, Baylor could provide a pickup service to these local waste producers. This would be a billable service that would provide the University both a source of revenue to support academic programs and biodiesel development.

**Ashleigh Myers, Dannie Dinh, and Reyna Anderson**

**Faculty Mentor: Dr. Susan Bratton**

Impact of Urban, Natural and Wilderness Settings and of Three Types of Day Hiking on Perception of the Natural Environment

Twenty-five college students participated in over 200 day hikes divided into three types: 1) goal oriented 2) nature study and 3) incorporating prayer or meditation. Hikes occurred in three settings within the deciduous forest biome: urban with human development, natural woods or wetlands, and national park with wilderness management. Analysis via SPSS 17.0 programs utilized procedures: means, crosstabs, nonparametric, and correlation. Using a 0 through 5 scale from "not at all" to "exceptionally", hikers responded to 25 terms describing the natural environment. Selected descriptors, including "interesting," "diverse," "fascinating," "awing," and "educational" were given significantly higher rankings on nature hikes. "Inspiring," "wondrous," and "sacred" had their highest rankings for spiritual hikes, while the rankings for nature hikes were higher than those for goal oriented hiking. Descriptors such as "enjoyable," and "relaxing" were not significantly different for different types of hikes. The rankings of all descriptors differed significantly by the degree of naturalness, except for "boring" and "crowded." The results imply that both educational and spiritual activities can, on average, improve or enhance hiker perceptions of the natural environment.

**Ashleigh Myers**

**Faculty Mentors: Dr. Lynne Baker and Julie King**

Environmental Security in Post-Conflict Peacebuilding: An Assessment of UNEP's Environmental Peacebuilding Initiatives

Conflict is both constant and inevitable, ultimately establishing and shaping societies throughout time. Environmental and natural resource-related factors directly ignite tensions, act as an underlying contributing factor to conflict, and provide the means by which to maintain conflict. Paradoxically, the scope of most national security measures fails to encompass environmental security. In post-conflict areas, the ability to maintain peace depends on a number of factors, including the type of stress that prompted conflict, the nature of the conflict, the terms of the peace agreement, and continued or new external and internal pressures. Because the environment is so intimately involved in the progression of war, it is a critical component of security and peace measures. The United Nations Environment Program (UNEP) has recognized environmental security in its post-conflict peacebuilding efforts and has begun incorporating environmental management as a tool for peacebuilding and peacekeeping, most notably in four key areas: high-value natural resource management, land management and distribution, water resource management, and the development of sustainable livelihoods. Using global case studies, I assessed the overall effectiveness of UNEP's environmental peacebuilding campaigns in each of these areas. Even though UNEP's efforts have resulted in the creation of protected areas and environmental regulatory agencies, I found that post-conflict environmental efforts did not translate into sustainable programs. UNEP operations lack initial inclusion of local people, have inadequate legal mechanisms and enforcement, and require an indefinite UNEP presence. As a result, it is unclear if these efforts can significantly contribute to lasting peace.

# Department of Family and Consumer Sciences

**Venée Hummel**

**Faculty Mentor: Dr. Janet Crow**

Parents' Perceptions of the Effects of Military Deployment on Their Relationships with Their Young Children

The frequent, lengthy deployments for service-members necessitated by U.S. involvement in Iraq and Afghanistan have generated increasing interest in the effects of war-time deployments for children in those families. Nonetheless, a need remains for additional research to understand their experiences. The purpose of this study was to explore how military parents perceive the effect of deployments on their relationships with their young children. Qualitative and quantitative strategies were used to assess parental perceptions and underlying relationships between deployment factors and the impact on children. Four focus groups were conducted with 26 participants, including service-members, spouses, and couples in dual-military marriages. The focus group transcripts were analyzed for themes representing indications of attachment behaviors and orientations, initial separation reactions, coping strategies, reunion reactions, and reintegration strategies and outcomes. Secondary analyses of quantitative data collected by the Department of Defense in a survey of service-members' spouses indicated that the perception of how the service-member "reconnected" with his/her children was significantly correlated with the spouse' readjustment to the service-member's return, the number of days away in the prior 12 months, deployment to a combat zone, post-deployment changes in the service-member, changes in the child's behavior, the spouse's reported difficulties with the deployment, and the spouse's level of stress and psychological distress. Discriminant analyses suggested that spouses who reported more difficulty with post-deployment readjustment, more days deployed in the last 12 months, and more changes in the service-member's attitudes and behaviors were likely to report service-member difficulty in reconnecting with children.

# Department of Geology

**Jake Gasaway**

**Faculty Mentors: Dr. Steven Dworkin and Dr. John Dunbar**

The Impact of Concentrated Animal Feeding Operations on the Organic Geochemistry of Reservoir Sediments

Organic C abundance in both reservoirs varied between 1 to 2 wt % and the C to N ratio varies between 6.5 to 8, indicating that the preserved organic matter is dominated by algal matter. The most distinct difference between the two reservoirs was the isotopic composition of N ( $\delta^{15}\text{N}$ ). The unaffected reservoir exhibits a  $\delta^{15}\text{N}$  of about 6 per mil throughout the sediment core. In contrast, the Kiker reservoir sediment exhibits a systematic increase in  $\delta^{15}\text{N}$  from 6 to 12 permil near the sediment surface. A 25% increase in organic C in the upper 20 cm of the Kiker sediment coupled with increasing nitrogen isotope ratios suggests that animal waste input has increased within the last 10 years. The C to N ratios of the organic matter, however, suggest that the nutrients in this animal waste have been utilized by algae growing in the reservoir, which are now preserved in the sediment.

**Brian Hines**

**Faculty Mentor: Dr. William Hockaday**

Analyzing the Effects of Volcanic Eruptions on Geomorphology

To understand the influence of volcanic eruptions on surrounding landscape in terms of mineralogy, composition, elevation, and future deposition, it is necessary to study the environment pre- and post-eruption. By analyzing core samples and present day landscapes, diagnostic features can be identified and post-eruption models of landscape evolution can be developed. This allows identification of other areas that have been modified, influenced, and subjected to volcanic eruptions. In this review, I will study the effect the eruption in AD 79 of Somma-Vesuvius had on the Sarno River Plain and how the eruption altered the landscape at the time as well as for future deposition.

**Jake Jackson****Faculty Mentor: Dr. William Hockaday**

Interpretations on the History of Mars' Magnetic Field

The magnetic field of Mars ceased to exist around 4 billion years ago. Scientists have studied why the magnetic field of Mars is so much different than that of Earth's, but have only begun to make significant progress in the past decade, thanks to the Mars Global Surveyor. The solar-wind interaction of Mars differs from Earth, due to Mars' magnetic field being very weak, less than 5 nT, which could be a possible explanation as to why Mars failed to hold a sufficient amount of liquid water and therefore be able to sustain life. Research is now focusing on the cause of the magnetic field collapse. A considered possibility is a series of asteroid impacts. The study of this magnetic field structure gives history to the insight of Mars as well as the early solar system. Mars is considered to be an analog to early solar system conditions due to the increased strength of the solar winds. In this paper I will present a hypothesis for the deterioration of the magnetic field and how this affected the course of Mars' geological history.

**Jennifer Lowery****Faculty Mentors: Dr. Stacy Atchley and Dr. William Hockaday**

Deep Water Carbonates

Shallow water carbonates have been a major source of oil and gas in the past, and oil companies are wading deeper into the ocean basins, exploring deep water carbonates as potential reservoirs. To better predict the locations of reservoirs, and to be able to affordably and efficiently locate and extract these resources, it is essential that deep marine carbonate environments be studied and understood. By studying the texture, composition, structure, stratigraphy, and biological patterns of deep water carbonate outcrops and the processes that operate within and influence deep water environments, we can predict the sediments and structures present in the deep basins today. By understanding the structure and sediments within these environments, we can construct models and, in addition to using other data sets such as 2-D and 3-D seismic data, well logs, and cores, we can predict the location of reservoirs. In this study, I will describe the characteristics of deep water carbonates, their structures, and the processes that form, influence, and operate within the deep marine carbonate systems to evaluate their potential to contain valuable volumes of oil and gas.

**Alkesta Maili****Faculty Mentor: Dr. William Hockaday**CO<sub>2</sub>-Enhanced Oil Recovery: Where It Does and Does Not Work

The injection of industrial carbon dioxide gas (CO<sub>2</sub>) in subsurface wells to increase the amount of crude oil that can be extracted from an oil reservoir is increasingly used by oil companies. The main purpose of this paper is to investigate the criteria needed for sustainable CO<sub>2</sub>-enhanced oil recovery and the type of settings that would disfavor this technique. More specifically, the viability of enhanced oil recovery for a specific reservoir is examined through its depth, temperature, pressure and capability of successful waterflooding. I will review case studies in locations throughout North America and other parts of the globe to draw generalized conclusions about the geologic conditions under which CO<sub>2</sub> injection is likely to enhance the recovery of oil and sequester carbon in the subsurface.

**Christopher A. Mehta**

**Faculty Mentor: Dr. John Dunbar**

Geodynamics of Coronae Formation on Venus

In this study, we perform a series of numerical experiments to better understand the formation of large circular indentations on the surface of Venus, called coronae. We use a finite element model that solves the Stoke's Equation for slow viscous flows. Coronae on Venus range in diameter from 20 to 1500 km and are common throughout the planet's surface. They are typically accompanied by volcanism and large areas of radial compressive displacement, directed outward from the centers. Some workers have suggested that these features are formed in response to mantle plumes. Others have suggested that they are formed as a result of the delamination of Venus' lithosphere. The purpose of this study is to model the two proposed trigger mechanisms to determine which one best explains coronae formation. On the one hand, the results show that even though the process of delamination does in fact form corona-like features, the time it takes to form the near circular indentions (which is a key property of coronae) is too long. On the other hand, when we model mantle plumes, the model shows plumes forming and rising through the mantle, eventually impacting the surface, creating coronae with all of their requisite features. The plume models run for a total of 50 million years in virtual time.

**Jordan Ray**

**Faculty Mentor: Dr. William Hockaday**

How Horizontal Drilling Brings New Life into Old Fields

Horizontal drilling has made a major impact in the oil and gas industry; it has allowed geologists to revitalize and expand existing fields while also making previously unconventional resources attainable. Unconventional resources accumulate in reservoirs with very low permeability and where oil and gas are closely adsorbed to the rock. Horizontal drilling was first developed in the 1800s and was not applied to oil and gas production until 1929. Unlike vertical wells, horizontal wells are more successful at extracting resources from the reservoir as they have improved contact with the formation. In this review I will analyze costs, benefits, and some of the drawbacks that horizontal drilling overcomes as compared with vertical drilling.

## Department of History

**Alexander E. Jania**

**Faculty Mentor: Dr. D.E. Mungello**

Female Fox Spirits: Beings on the Fringe

In every society there are boundaries that define what is normal and what is strange. Often cultures will explore these boundaries in stories about supernatural beings. These beings often occupy a grey area around accepted societal boundaries e.g. ghosts: beings that straddle boundary of life and death. While ghosts are common throughout most world cultures in China fox spirits compete with ghosts as the most popular figures in folklore. The female fox spirit in particular is an interesting rendition of this otherworldly being. There are many accounts of female fox spirits transforming into human women and preying on young scholar officials, often in the form of sexual intercourse. This type of fox spirit was often analogous to women on the fringes of society, like prostitutes or wives of foreign silk route traders, sharing many characteristics with these real life marginalized women. However as popular sentiment towards these fringe women evolved throughout history so did the role of the female fox spirit. Once a strictly malevolent being female fox spirits and their nature became more ambiguous and at times even benevolent. An archetype that began in traditional Chinese folklore as a popular morality fable evolved into a medium to explore man's relationship with the unusual.

# Department of Mathematics

**Caroline Clark**

**Faculty Mentor: Dr. Rishi Sriram**

Findings from the National Study of Student Affairs Professionals

Student Affairs is a fundamental component to the success of higher education. Professionals in student affairs are relied upon daily to contribute to the development of college students and the function of the institution. College Student Educators International (ACPA) and Student Affairs Administrators in Higher Education (NASPA) endorsed a joint publication in 2010 entitled, Professional Competency Areas for Student Affairs Practitioners. This publication identifies 10 competency areas for student affairs: advising, research, diversity, ethics, philosophy, human resources, governance, leadership, personal foundations, and student learning and development. This presentation examines the initial findings from the National Survey of Student Affairs Professionals, a robust survey that measures professionals across the nation on their knowledge, skills, and attitudes concerning the 10 professional competency areas for student affairs. The purpose of this presentation is to quantitatively analyze the relevance of the 10 competencies to student affairs, identify where professionals report being most competent and identify where professionals need more emphasis on personal development.

*(Student is majoring in Mathematics; project was conducted in the Department of Educational Administration, School of Education.)*

# Department of Modern Foreign Languages

**Sydney Condie**

**Faculty Mentor: Dr. Frieda Blackwell**

The Effect of Romanticism in Larra's El Casarse Pronto y Mal

As one of Spain's most famous essayists, Mariano José de Larra is best known for his essays, written in a romantic style. His "artículos de costumbre" often criticize the customs and traditions of Spain, including the antiquated educational system. Through his fictitious alter ego and spokesman Fígaro, Larra is able to present his liberal ideas and critique Spanish society without fear of offending the people. Larra bolsters his arguments by using a romantic writing style, which allows him to appeal to his readers on an emotional level, rather than to their purely rational side. In his essay, "El Casarse Pronto y Mal," Larra presents the hasty marriage between a French man and a Spanish woman that ends disastrously not long after the couple ties the knot. Larra critiques both Spanish and French societies, using the romantic aesthetic, to make an emotional appeal. Furthermore, through exaggeration and humor, Larra sets up a marked contrast between Spanish and French societies—achieving a devastating critique of the lack of progress in Spain but also suggesting that simply copying France's behaviors will not solve Spain's problems.

**Dresden Hasala-Shooks****Faculty Mentor: Dr. Paul Larson**

Borges's El Zahir: The Lure of Obsession

The title of "El Zahir," the short story by the Argentine magical realist Jorge Luis Borges, refers to the Islamic myth of an object or person that can inspire a profound obsession in the person that possesses it. In Borges' story, the actual Zahir is a coin from Buenos Aires worth 20 centavos. Figuratively, the coin, as a Zahir, is a symbol of free will. For the man who possesses it in El Zahir, the coin is representative of his lost love. This man, also named Borges, understands that the coin is a Zahir; additionally, he believes the coin has the power to drive him mad and, out of fear, wishes to rid himself of it. In his desire to get rid of it, he becomes obsessed with it. What he truly did, however, was substitute the pain he felt regarding the death of the woman he loved for an obsession with the coin, which was, to him, a more tolerable emotion. The death of the woman he loved simply allowed him to have the appropriate state of mind in which an obsession such as that of which he speaks in "El Zahir" could take hold. I will show that the symbol of the Zahir stands equally for love, grief, and obsession in one man's life as he comes to terms with death and loss in 20<sup>th</sup> century Buenos Aires.

**Benjamin Moss****Faculty Mentor: Dr. Frieda Blackwell**

Moratín's Utilidad en "La comedia nueva"

Leandro Fernández de Moratín (1760-1828) escribió una obra de teatro famosísima que se llama, "La comedia nueva." Dentro de la obra, Moratín critica la sociedad española a través del uso del concepto de la "utilidad," un ideal neoclásico. Con los personajes principales, don Pedro, don Eleuterio, y don Hermógenes, Moratín revela tres caminos diferentes que apoyan o rechazan el desarrollo de la "utilidad" en la vida y comportamiento del individuo. Por un lado, el pedante, don Hermógenes, no cambia de los viejos castellanos, los "pedantes," y su ignorancia representa la "inutilidad" en la sociedad neoclásica. En contraste, el hombre útil, don Pedro, mantiene su lealtad de ser útil a la sociedad española a lo largo de la obra. Sin embargo, el hombre que enfatiza la crítica social más, es don Eleuterio, porque él cambia su comportamiento completamente y se vuelve el hombre útil de la obra. Moratín usa el contraste entre el pedante, "inutilidad," el hombre útil y el hombre que evoluciona de "inútil" a "útil" contribuye al bien público para ilustrar el camino malo de "inutilidad" e invocar una pasión dentro de su público para cambiar a contribuir de manera "útil" a su sociedad.

**Sierra Phillips****Faculty Mentor: Dr. Frieda Blackwell**

La hipocresía de la burguesía en "La Nochebuena de 1836"

Essayist and leading figure of the Romantic Movement in Spain, Mariano José de Larra won fame for his "artículos de costumbre," in which, using the pen name Fígaro he satirized Spain's foibles and problems. His last remarkable essay, "La Nochebuena de 1836," presents a critique of the upper class through an unusual switch of roles between master and servant. Christmas Eve or "la Nochebuena" is the one day per year in which servants can rebel and express their opinions about their masters without fear of being punished. Fígaro, a typical aristocrat, instructs his servant to follow the old tradition and tell him the truth on Christmas Eve. Fígaro believes himself to be a liberal and a great supporter of the lower classes, but the harsh critique from his servant forces him to question whether he truly acts upon his romantic, liberal ideals. At the end, it is clear, not only from the servant's words, but also from careful observation of Fígaro's attitude towards the lower classes, that socially advanced liberals like Fígaro exacerbate the very problem in Spanish society that they condemn. Fígaro's idealistic critiques reveal his own hypocrisy and result in his own self-condemnation.

**Sarah Rabke**

**Faculty Mentor: Dr. Paul Larson**

Julio Cortazar's "Segunda vez" as "literatura comprometida"

Julio Cortázar was an influential Argentine writer from the twentieth century. Cortázar is best known for his short stories that play with the impossible, the surreal and the absurd, but in the story “Segunda vez,” Cortázar also addresses his political concerns. “Segunda vez” is a protest against the injustice and repression of the Dirty War in Argentina in the 1970s, particularly the disappearance of thousands of political prisoners. In Cortázar’s short story, he makes note of the government’s brutality by creating a sense of fear and indignation in the reader. He divides the characters into two groups: the indifferent and heartless employees, “those who know,” and the unsuspecting and seemingly innocent citizens, “those who do not know.” It is my contention that this double perspective gives the reader more information and allows them to see the true horror and cruelty of the government officials while sympathizing with the victims Carlos and María Elena. Cortázar also makes the horror more real to his audience through the use of detailed descriptions of the suspicious atmosphere of the government office, which the characters choose to ignore. The notice calling the citizen to come to the office, the location of the office, the inside of the building and the ominous feeling throughout the office procedures create suspense and fear in the reader. Finally, Cortázar’s story ends unresolved. There is no body, no explicit death. Carlos has mysteriously disappeared, and the reader knows that María Elena will be the next victim. Through the use of all these literary techniques, Cortázar and his “literatura comprometida” calls worldwide attention to the inhuman practices of the Argentine government.

**Adithi Rajapuram**

**Faculty Mentor: Dr. Paul Larson**

The Reconciliation of Absurdity and Realism in “The Switchman” by Juan José Arreola

Juan José Arreola’s short story “The Switchman” examines allegorically the existential angst and the frustration of daily life brought about by corruption, inefficiency, and uncontrolled bureaucracy in Latin America. The story about a lost traveler and a wizened old switchman has long faced controversy over conflicting interpretations of this allegory. My explication of the primary text coupled with evidentiary support from secondary literary criticism suggests that Arreola is exploring the daily conflict between what one wants to do versus what society will allow them do, accepting the absurd to our greatest ability while continuing to live as best we can, even if it is not in our plans. The traveler’s lack of distinguishing features represents him as a medieval Everyman with whom the reader identifies and empathizes. His fastidious inability to understand the illogical and unpredictable train system causes him to expend his frustration on the switchman, who pleasantly recounts tales of ludicrous, if not surreal, incidences with the trains. By working together to embrace the unexpected and unwanted, the passengers already on the trains remain content regardless of the absurdities that befall them, because they do continue to move from one destination to another even if those are unwanted or unexpected. Meanwhile, in a surreal scene reminiscent of Dante’s *Inferno*, those who wait endlessly on the platforms fight one another each time a train arrives instead of boarding before its departure. The traveler ultimately forgets his original destination, T, for the unknown location, X, signifying a change in focus from a fixed, nonnegotiable endpoint to the journey gifted him by the god-like switchman.



**José Reyna**

**Faculty Mentor: Dr. Frieda Blackwell**

Iriarte's Use of The Poetic Fable: A Perspective of Social Criticism Through the Analysis of Fable III and Fable XLII

The “Enlightenment” of the eighteenth century proved to be a strong intellectual movement that coincided with the neoclassic esthetic tradition. Its objective was to develop curiosity for the sciences, knowledge, and learning to better society. The goal of many literary works of said period was to “educate” their readers, whether explicitly through essays or implicitly through theater and poetry. Tomás de Iriarte was a seminal author, along with Félix María de Samaniego, of the poetic fable. These fables, typical of neoclassical art, had the goal of teaching their readers moral, ethical, and practical values. Enlightenment thinkers focused on what was useful, logical, and practical for the general advancement of society. Nevertheless, a whole social class, the aristocracy, consisted of people whose job was only to engage in idle leisurely pursuits that were unproductive and contributed nothing to society; in fact, they were social parasites. “The fool,” whose efforts are made in vain, is a person from whom we have much to learn, according to Iriarte and others. In his poems from *Fábulas literarias* (1782, 1st edition), Iriarte utilizes the poetic fable, the characters involved, and the dialectic structure of his poems to demonstrate the significant distinction between idle leisure “lo ocioso” and what is of value “lo valioso” to Spanish society, as epitomized in his poems “El oso, la mona y el cerdo” (“The Bear, The Monkey, and The Pig,” poem III) and “El gato, el lagarto y el grillo” (“The Cat, The Lizard, and The Cricket,” poem XLII).

**Nichollette Wilkerson**

**Faculty Mentor: Dr. Paul Larson**

Violence, Hate and Fear in Matute's "Los chicos"

In post-civil war Spain, the context of Spanish author Ana María Matute’s short story entitled “Los Chicos,” there appear two distinct (but similar) groups of adolescent boys whose members violently clash amongst one another. Though the two bands of young boys have been convinced by society, their culture, and their own families that they share nothing in common, they, in truth, differ only in one “major” respect: each group resides on a different “side of the tracks.” One group are the children of the guards at a local prison, the others are children of the prisoners. As a direct result of being cultured to believe that they, as boys growing up from different backgrounds, should not and shall not intermix, these bands of juveniles learn to exhibit a visible hatred towards each other. By using two groups of socially-affected adolescent boys, Ana María Matute illustrates her a primary theme of baseless and unjust prejudice as its destructive effects trickle down from its social origins to interfere with the innocence of children. I hope to show that this story is both “realistic” and allegorical, reflecting how the “sins of the fathers” are visited on the children of the prisoners, but I also hope to show that these groups of boys are metaphors for the winners and losers of the Spanish Civil War and that the end of the war resolved nothing, leaving unresolved conflicts and opens wounds which continue to breed bigotry, hate, and violence.

## Department of Physics

**Amir Ali**

**Faculty Mentor: Dr. Zhenrong Zhang**

TiO<sub>2</sub>(110) Sample Preparation & Installation of Molecular Doser

TiO<sub>2</sub>(110) 1×1 surfaces were prepared for the study of the photo-catalytic properties of titanium dioxide using scanning tunneling microscopy (STM). After sputtering and annealing a rutile TiO<sub>2</sub>(110) single crystal over the course of several months, we obtained atomic-resolved STM images on the prepared TiO<sub>2</sub>(110) 1×1 surfaces. The STM tip quality is critical for the performance of STM. Two electrochemical tip etching set-ups were developed for two different STM systems. Tungsten tips were etched and characterized using scanning electron microscopy.

**Will Barnes****Faculty Mentor: Dr. Lorin Matthews**

Orbital Parameters of Circumplanetary Dust: Modeling Saturn's F Ring

The motion of charged dust in Saturn's F Ring is examined using a numerical model. The numerical model was validated by reproducing data for the orbital parameters for circumplanetary dust at Mars and in Saturn's E Ring. Additional forces, such as the gravitational force from the F Ring's shepherding moons and solar radiation pressure were then added to the numerical model. This allows us to examine the behavior of dust grains with specific sizes in order to better understand the anomalies in this Saturnian object.

**Evan Bauer****Faculty Mentor: Dr. Kenichi Hatakeyama**

Supersymmetry Search: Limit Calculation and Exclusion for the Constrained Minimal Supersymmetric Standard Model

Last summer I participated in the work of the RA2 group analyzing data from the CMS experiment at CERN. This group performed a search for signs of Supersymmetry (SUSY) at the Large Hadron Collider using Missing Transverse Energy (MET) and jets. Of particular interest for my work was the compatibility of the data with expectations based on the Constrained Minimal Supersymmetric Standard Model (CMSSM) formulation of Supersymmetry. Since our analysis found no evidence of Supersymmetry in many of the search regions, an important result of this analysis involved calculating limits on the exclusion of certain CMSSM parameter mass regions at the 95% confidence level. The results are displayed in a contour plot showing excluded mass regions for the CMSSM parameters  $m_0$  and  $m_{1/2}$ , the uniform scalar mass and the gaugino mass respectively.

**Nathan Beasley****Faculty Mentor: Dr. Jeffrey Olafsen**

Characterization of Granular Shear Flow using Magnetic Resonance Imaging

From pharmaceutical powders to cereal, corn to ammunition, many processed multi-particle materials are broadly known as granular matter. Though many granular properties are yet to be formally characterized, granular media exhibit features of solids, liquids, and gases, and thus can be thought of as a natural state in their own right. Therefore, this research is designed to help understand and improve many industrial processes. The dynamics of tracer particles in a granular shear flow are extracted using a tracking program written in IDL. Optimizing both the tracking program and the Magnetic Resonance Imaging instrument sensitivity for thirty-six mustard seeds (tracers) in a porcelain medium, data is taken for various shear scales. There is significant analysis to be performed with this data, such as dilation/compression of the medium and particle diffusion, but the current focus has been on data collection. As the research continues, we hope to characterize the flow of granular material for various size ratios of medium to tracer particles.

**Kyle Brown****Faculty Mentor: Dr. Kenneth Park**

Low Energy Electron Diffraction Study of TiO<sub>2</sub> (110) 1x2 Surface Analysis

A sample of TiO<sub>2</sub> (110) was sputtered and annealed in an Ultra High Vacuum (UHV) chamber to reconstruct a 1x2 surface multiple. Sputtering was done with Ar<sup>+</sup> for ~15 minutes in order to clean the surface of impurities. Annealing was accomplished by using a high voltage source to provide ~1100 V and 3mA to maintain temperatures of ~700 ° Celsius for 15 minutes so that the surface could rearrange and "smooth out". These processes were followed by the cooling period after which the entire cycle was repeated between 15 -30 times. After a satisfactory number of cycles had been completed, Low Energy Electron Diffraction (LEED) patterns were recorded. These photographs were then imported into LEED Analysis Master Control (LMAC), a LabVIEW software, in which the LEED-IV curves were extracted. These curves were compared to published material to confirm these methods could in fact produce structures consistent with previous models.

**Kristen Deline****Faculty Mentor: Dr. Lorin Matthews**

Interaction of Charged Aggregates in GEC rf Reference Cell

Dust aggregates are formed in a laboratory plasma as monodisperse spheres are accelerated in a self-excited dust density wave. Interactions between pairs of aggregates allow their charge, mass, and gas drag to be inferred. The asymmetric charge on the aggregates causes them to rotate as they interact with each other. Through these interactions, the charge and dipole moment can be estimated and compared to numerical models.

**Janie Hoormann****Faculty Mentor: Dr. Dinshaw Balsara**

Magnetic Fields in a Supernova-driven Stratified Disk

It is known that the interstellar medium is highly turbulent, but understanding the effects of that are still an active area of research. Possible sources of turbulence include supernovae explosions, solar winds, and the magneto-rotational instability, but as one of the main contributors, this simulation focuses on the effects of supernovae explosions. These are set up by injecting spheres of high energy near the midplane of the disk. This model sets up a stratified disk, as the interstellar medium varies in temperature with regions of cold gas ( $T < 2000\text{K}$ ), warm gas ( $2000\text{K} < T < 10^5\text{K}$ ), and hot gas ( $T > 10^5\text{K}$ ). The stratified disk is kept in both hydrostatic and thermal equilibrium to prevent the disk from initially collapsing. The size of this disk is set to be  $0.5 \times 0.5 \times 3.0 \text{ kpc}^3$ . A shearing sheet approximation is used to account for the galactic rotation and the periodic boundary conditions. This research aims to see how the magnetic fields in the interstellar medium are affected by turbulence. To this end, a small initial magnetic field is set up using an ABC flow which models the necessary chaotic streamlines. Preliminary results indicate that the magnetic field is amplified after the supernovae explosions cause turbulence.

**Kimberly Orr****Faculty Mentor: Dr. Dwight Russell**

Experiences in Observational Astronomy

Observational astronomy utilizes many types of tools. Telescopes, cameras, and computers allow for the collection of astronomical data which is then analyzed using techniques that will be described below. Our most recent observations are of Trans-Neptunian Objects (TNOs) at true opposition and at larger solar phase angles. We include binary TNOs as well as those not currently known to have multiple components. We are testing the hypothesis that ejecta exchange enhances the opposition surge of binary TNOs by producing a surface with the complex microtexture conducive to the constructive interference which produces the effect manifested at the smallest phase angles.

**Forrest Phillips****Faculty Mentor: Dr. Kenichi Hatakeyama**

Z Boson to Neutrino Background Estimation for Supersymmetry search at the LHC

Last summer I worked with the CMS experiment RA2 team, which searched for Supersymmetry and dark matter particle candidates in the data from the Large Hadron Collider through the use of jets and missing energy. There are many backgrounds that mimic the signal for Dark Matter. I was put in charge of estimating the Z boson to neutrino background, one of the major and irreducible backgrounds in the search, through a comparison of W to muon + neutrino events. To start I removed background events from the W to muon + neutrino sample. The major background left was top anti-top quark pair + jets events, which is reduced by removing the events including the bottom quark. After all the backgrounds were removed I applied multiple efficiencies and acceptances to get the true number of W to muon + neutrino events. Then I used the branching ratios of the Z to neutrino and W to muon + neutrino decays to get the number of Z to neutrino events.

# Department of Religion

**Brad Aldridge**

**Faculty Mentor: Dr. Mikeal C. Parsons**

The Political and Economic Critique of Rome in Revelation 13, 17-18

While there is certainly no agreement between mainstream theologians and Biblical literalists on the overall interpretation of the book of Revelation as a whole, it seems there is recognition among both groups that, in the words of Thomas Edgar, Revelation 17-18 illustrates "the destruction of a system of international economic or commercial interests [that] has exercised influence or control over all the political rulers and governments of the earth." In this paper, I discern that in the original context of New Testament apocalyptic theology, this system, as represented in the images of beast and prostitute, is clearly Rome and its imperial cult in its powers of economic idolatry and religious persecution. We will first examine the scholarly commentary which identifies the beast of Revelation, its false prophet, and its mark with Domitian, the "Nero Redivivus" myth, the imperial cult's propaganda machine, and Roman currency. Then, we will explore the parallels between the symbol of harlot Babylon and depictions of Babylon and Tyre in various Old Testament passages referring to those ancient cities, concluding that the author means to compare the ancient commercial plight of Israel under Tyre and its political plight under Babylon with the even greater plights of the Christians, the poor, and the enslaved under Rome. Finally, we briefly recognize the apocalyptic ethos and theology in John's urging of early Christians to withdraw from Rome's economic oppression and material wealth and seek the hope of the New Jerusalem and its wealth of humanity's redemption.

**Laura Beth Hooper**

**Faculty Mentor: Dr. Mikeal C. Parsons**

The Significance of the Similarities between Baal and Yahweh Found in Hosea 1-2

This paper endeavors to determine the significance of the similarities established between the figures of Baal and Yahweh in Hosea 1-2. The exploration of this subject pulls from research from a variety of Biblical commentaries and academic papers. Through an in-depth investigation of the seeming comparison Hosea creates between Baal and Yahweh, it became clear that these similarities were only surface deep and were, in actuality, designed to accentuate the more critical contrasts between these characters.

**Elise Kappelmann**

**Faculty Mentor: Dr. Mikeal C. Parsons**

The Canonization and Role of Esther in the Old Testament

This essay is an exploration of the controversies concerning the content of Esther during the process of its canonization as a part of the Old Testament, discussing some of the most important and frequently debated objections. Additionally, the essay addresses how Esther fits into the Old Testament as a whole.

**Thomas McGraw**

**Faculty Mentor: Dr. Mikeal C. Parsons**

Peter's Appropriation of Joel on Pentecost

The Apostle Peter's utilization of the prophet Joel in his sermon on Pentecost represents one of the earliest recorded instances of Christians homiletically using the Old Testament scriptures to convey the message of the church. This paper explores the reinterpretation that Peter applies to the words of Joel, as well as the potential Lukan changes that may have arisen during the composition of the book of Acts. Two major focuses of this paper include the broadening of Joel's promise of spiritual restoration from ethnic Israel to the diaspora and finally to include all people, as well as the eschatologically loaded additions to the Joel text that appear in the sermon, fitting Peter's hermeneutical standard. Ultimately, this paper seeks to find an example of Christian appropriation and reinterpretation of Jewish texts to serve as a model for the modern church's use of the Old Testament as scripture.

**Scott Steinhouse****Faculty Mentor: Dr. Mikeal C. Parsons**

Discipleship in the Gospel of Mark

This paper has come out of a desire to search what it looks like to truly follow in the footsteps of Jesus as a young adult in contemporary America and what the obstacles are in reaching that goal. From experience in what I have seen around me both growing up and talking with others, I have outlined three distinct issues that I feel are properly addressed in the Gospel of Mark and, using passages from this book, I begin to show how these texts need to be applied in the lives of youth today. Although the focus is for this paper to be directed toward a younger demographic, I feel the message can, and should, be applied to those of all ages.

**Jake Surges****Faculty Mentor: Dr. Mikeal C. Parsons**

Music and Spirituality in Ancient Israel

Ancient Israelites lived in a community abounding with music. Before the era of the Kings, Israelites did not view musicianship as a profession but as a general part of the Israelite heritage. Such common musicality led naturally to a community where music played many important roles. Throughout the Old Testament, these roles included incorporation of music with rituals, worship, processions, mourning, and celebrations, and in several cases, certain Israelites used music to manage spirits. This research paper will explore the relationship between music and spirituality, focusing on three instances: David calming Saul with music, Elisha prophesying, and Saul prophesying. After examining the musical aspects of each passage, this paper will show the exact musical causes: instrumental music, singing, and dancing, and will then show the resulting spiritual effects: spiritual soothing and prophesying. These analyses will ultimately illustrate the temporality with which music affects the soul. By illuminating each cause and effect, the study should offer brief insight to Biblical Scholars and help them gain a greater understanding of how to wholly define music's role in Israel. Also, music's role in ancient Israelite worship resonates with music's role in corporate worship today. Thus this study should help educate worship leaders on how to fully utilize music as a tool for spiritual arousal towards God.

**Faith Walters****Faculty Mentor: Dr. Mikeal C. Parsons**

Women Who Begat

This essay addresses the reasoning behind Matthew's inclusion of the four women in the genealogy of Jesus found in Matthew 1:1-17: Tamar, Rahab, Ruth, and Bathsheba. It discusses several proposed theories, finally concluding that, as Gentiles, these four women's inclusion in the genealogy seeks to show that Jesus came to save the Gentiles also, not just the Jews, and that God was willing to use faithful Gentiles to accomplish His will when His own people were lacking in faith.

**Sarah Woodley****Faculty Mentor: Dr. Mikeal C. Parsons**

Challenging Baal

While Baal is seen in the Bible as the main opposing force against Yahwism, the Canaanite god is still left as an overall mystery to readers. The greatest collision between Yahweh and Baal appears in 1 Kings at Mount Carmel, when Elijah uses the power of Yahweh to outperform the prophets of Baal at a time when Baal worship was at its strongest. Although this confrontation at Mount Carmel is portrayed as an important event in the Bible, its significance cannot be fully understood without considering the prominent presence of Baal in the account of Elijah's time localized in the Old Testament. A better understanding of the Baal cult and its worship in ancient Samaria illuminates Elijah's challenge of Baal in the Book of Kings. In the Bible, Baalism is characterized as a lustful, primitive religion; however, to the nomadic Israelites entering the agricultural area of the Canaanites, Baalism was a means of understanding fertility in agriculture and the importance of life cycles through its detailed myths of personal gods. When Baalism was to the point of replacing Yahwehism as the religion of the Israelites, Yahweh used Elijah to show that He is clearly the supreme power, having control over all that was thought to be Baal's domain, such as lightning and, through rain, fertility. Elijah's challenge of Baal was important step towards the strengthening of Yahwism, leaving many shocked that their supposedly powerful god, Baal, was nonexistent and convincing many Israelites to follow their creator who had led them to freedom so long ago.

# Department of Sociology

**Taylor Roth**

**Faculty Mentor: Dr. Kevin Dougherty**

Alone, Together: Social Anxiety among College Students

It is estimated that one out of every ten university students will deal with social anxiety at some point in their college career. However, little research has been done on this population, and consequently, not much is known about the life of a socially anxious college student. This study was conducted to reveal characteristics that define socially anxious students and whether or not those affected feel a sense of unity. I interviewed ten self-described socially anxious university students, with questions ranging from family life to current college experiences. Several common themes emerged, including family structure, lack of a social support system, physiological problems and paucity of activity participation. Based on these findings, ideas for future research and recommendations to universities for helping socially anxious students are proposed.

# Department of Statistical Science

**Jonathan Tingle**

**Faculty Mentor: Dr. Jeanne Hill**

A Comparison of Statistical Inference Techniques for Iodine Deficiency Data

Over the past thirty years, Bayesian statistics has gained considerable popularity as an alternative to classical statistical inference techniques due to the intuitive nature of its conclusions and its ability to update prior knowledge about the population parameter of interest. This study seeks to compare the methodological and inferential differences between the two paradigms, with special consideration of the implications of quantitative differences between their respective parameter estimates. This study applies its analysis to data collected on iodine deficiency in Kenya. Iodine deficiency is a serious public health concern for more than one billion people worldwide and is a leading risk factor for a wide range of thyroid disorders, including endemic goiter.

*(Student is majoring in University Scholars; project was conducted in the Department of Statistical Science.)*

# School of Education

## Department of Educational Administration

**Caroline Clark**

**Faculty Mentor: Dr. Rishi Sriram**

Findings from the National Study of Student Affairs Professionals

Student Affairs is a fundamental component to the success of higher education. Professionals in student affairs are relied upon daily to contribute to the development of college students and the function of the institution. College Student Educators International (ACPA) and Student Affairs Administrators in Higher Education (NASPA) endorsed a joint publication in 2010 entitled, Professional Competency Areas for Student Affairs Practitioners. This publication identifies 10 competency areas for student affairs: advising, research, diversity, ethics, philosophy, human resources, governance, leadership, personal foundations, and student learning and development. This presentation examines the initial findings from the National Survey of Student Affairs Professionals, a robust survey that measures professionals across the nation on their knowledge, skills, and attitudes concerning the 10 professional competency areas for student affairs. The purpose of this presentation is to quantitatively analyze the relevance of the 10 competencies to student affairs, identify where professionals report being most competent and identify where professionals need more emphasis on personal development.

*(Student is majoring in Mathematics; project was conducted in the Department of Educational Administration, School of Education.)*

# School of Engineering and Computer Science

## Department of Mechanical Engineering

**Haden Duke**

**Faculty Mentor: Dr. David Jack**

Methods for Sectioning and Imaging of Composite Parts for Calculating the Fiber Orientation within a Processed Composite

Short-fiber polymeric composites are used extensively in industry where the reinforcing material is often a synthetic material. In this research we seek to characterize the processed material properties of select natural and synthetic fiber-reinforced composites based upon three-dimensional orientation of fibers within a polymeric matrix. Numerous experimental methods and mathematical models demonstrate how the orientation of the fibers control the processed properties of the fiber-reinforced composite and how the final orientation of fibers is dependent on the gradients of the velocity field during mold filling. This research seeks to model and characterize this process by observing the fiber orientation in post-processed parts employing microscopy techniques (both SEM and Optical). Once the results are obtained and the physics based models are validated and refined, engineers can confidently design products that will produce a desired mechanical characteristic. Initial analysis has validated the working process and exposed areas in which to improve sample preparation and image analysis techniques. From the captured images, this research utilizes the method of ellipses to systematically obtain the orientation of fibers in cut and polished cross sections of fiber-reinforced composites using a MATLAB code developed as part of this research. In addition to obtaining the three-dimensional fiber orientation, this research provides experimental values for fiber area and aspect ratio based on the processed images. The meshing of these values allows for optimized processing of composites, Additional work has been performed to experimentally determine the mechanical properties of the fiber-reinforced composites using polymer characterization techniques including results from a Dynamic Mechanical Analyzer for later use in the validation of the structural stiffness predictions.

**William Minnie**

**Faculty Mentor: Dr. David Jack**

In-Situ Observations of Fiber Orientation within a Parallel Plate Rheometer, for Applications in Short Fiber Composites

Injection molded plastics with discontinuous fiber reinforcements are used extensively in industry. Understanding and predicting the fiber motion is key to understanding the strength characteristics of final processed reinforced plastic. Once researchers understand how particulates move under different flow conditions, they will have the ability to predict the strength of a material thus significantly reducing the product development costs. In this study we have fabricated an apparatus that will allow for the viewing of particulates in different fluids under varying shear rates. Tracking the motion of these particulates is being done by the use of an optical microscope with a 10 MP 30 FPS camera. We are developing techniques to take the images captured in MATLAB to analyze the location and orientation of each fiber. Calibrating the viewing apparatus for viscosity measurements has been a significant concern because there is a need to know how the particle motion and density alters the observed viscosity of the fluid at different shear rates in different fluids. Initial tests have shown that the viewing cell may only be off by a linear shift of an order of magnitude over the entire range of shear rates observed, and most importantly the viscosity trends observed are the same as compared those obtained using Malvern's Pelteir Cylinder. At the completion of this project, the goal is to capture the motion of a dilute suspension of particulates at known shear rates. Once this is known it can be combined with the investigators' existing code for particulate motion to validate and refine the theoretical assumptions.

## **School of Music**

### **Division of Music Education**

**Christine Cookus, Abby Garrett, Kate Sutton, and Katherine Wray**

**Faculty Mentor: Dr. Russell Gavin**

The Effect of Audio Recording and Playback on Error Detection Among Instrumental Music Students

This study examined the use of audio recording and playback in the private lesson setting, with a specific focus on the effect of audio playback on student self-assessment and error detection. Middle school student musicians (N = 72) completed a self-assessment immediately following their individual performance of an etude. The student musicians then listened to a recording of their individual performance and completed another self-assessment. A third self-assessment occurred two days later, again utilizing the recorded performance as subject material. The self-assessment tool asked students to rate individual aspects of their performances on a 7-point Likert scale, with 1 representing "not good at all" and 7 representing "very good." Results indicated that student perception of tone, pitch accuracy, rhythmic accuracy, and dynamic expression was most favorable immediately after performing the etude. All of these skill sets were perceived less favorably in the recording immediately following the performance, with ratings of tone quality and pitch accuracy dropping by the largest amount. A smaller drop in ratings also occurred between the second self-assessment and the final self-assessment. This observable was found to be less sensitive to the effects of increased luminosity and may be a powerful observable for future CMS data analysis.



# Undergraduate Research and Scholarly Achievement (URSA)

## **URSA Student Assessment**

**Faculty Mentor: Dr. Susan Bratton**

Relative Contributions of Faculty, Undergraduates, and Graduate Students to Forming a Community Supportive of Undergraduate Research Experience

A survey of 243 undergraduate research participants at Baylor University, Waco, TX, found their reported level of interaction with faculty other than their research mentors was positively correlated to student perceptions of multiple indicators of research skill acquisition and the value of research to future graduate and professional options. Higher levels of research support from graduate students and postdoctoral researchers produced fewer significant correlations with skills acquisition, while contributing as significantly to the value of the research to future planning. Receiving research assistance from other undergraduates was largely neutral, while producing a negative correlation with improved writing skills. Formation of undergraduate research teams is potentially more effective for the data acquisition-based and quantitative research modes of STEM, than for the qualitative and writing based modes of the humanities. Undergraduates with projects lasting more than one semester or intending to present off-campus or publish research reported greater levels of skills acquisition and considered research more valuable to their future professional options.