2014 Fall Research Symposium Abstracts

Poster Abstracts

1:30 – 1:55 pm, NHS Atrium

Griffin Reed

The spectrum and prevalence of* ACTN2 *mutations in sudden unexplained death in the young

Mayo Clinic
Advisor: Dr. Michael Ackerman

Cardiac channelopathies – diseases caused by abnormally functioning cardiac ion channels – are a major cause of autopsy negative sudden unexplained death and can result in as many as 1,000 deaths per year. A mutation in *ACTN2*, a gene that encodes for a cardiac ion channel interacting protein, could affect the linkage between ion channels and the actin cytoskeleton, altering ion flow, and potentially resulting in a cardiac channelopathy. The purpose of this study is to determine the spectrum and prevalence of *ACTN2* mutations in sudden unexplained death in the young. PCR, denaturing high-performance liquid chromatography, and DNA sequencing were utilized to screen a cohort of young individuals who experienced sudden unexplained death for mutations in *ACTN2*. Using these techniques, two mutations were found and subsequently evaluated for pathogenicity using a combination of statistical and *in silico* prediction techniques. One of these mutations was determined to be potentially pathogenic; however further functional characterization (ie. patch clamp) is necessary to label this mutation as pathogenic or benign.

Kate Schulze

Interneuron vulnerability in aged monkeys with memory impairment

National Institutes of Health
Advisor: Dr. Amy Spiegel

This summer I studied the effects of normal aging on interneurons in the monkey prefrontal cortex specifically area 46, a region shown to be involved in working memory, which declines with aging. Previous data has shown there is no overall neuronal loss in this region of the brain so we must now look for finer changes which may be occurring and contributing to this memory impairment. One possible explanation may be in changes within interneurons, specifically looking at parvalbumin-expressing neurons. The goal of my project was to quantify the total number of parvalbumin-expressing interneurons in dorsal area 46 of the monkey prefrontal cortex. My hypothesis was that we would see a change occurring in the number of neurons expressing parvalbumin in the aged monkeys compared to the younger ones. The tissue was taken from a group of animals tested on a delayed-response task. After immunohistochemistry was performed on the tissue samples the neurons were quantified using unbiased counting methods. My results showed there was a significant increase in the number of neurons expressing parvalbumin in the aged monkeys compared to their younger counterparts. This supported my hypothesis and also lends support to the importance these neurons may play in age-related working memory impairments and speaks to possible therapeutic targets for the treatment of such memory deficits.

Guillermo Turcios

Characterization of Fe^{3+}-pyrazole coordination complexes

Gustavus Adolphus College
Advisor: Dr. Steve Miller

The purpose of this study is to UV-visible spectrophotometry to characterize partially ligated iron(III) complexes in aqueous solution, and to use the results to determine the equilibrium constants for the sequential complexation reactions which drive formation of complexes with increasing numbers of pyrazole ligands. Characterization is achieved by collecting spectra for a series of solutions in which the iron(III) concentration, ligand concentration, and ionic strength are all varied. Statistical deconvolution on the resulting spectra is employed to determine individual absorption profiles and equilibrium constants. An attempt to collect Raman spectra for this metal-ligand system was also made. Future work will include the study of systems composed of other transition metal ions and/or ligands and computational characterization of observed species.

Presentation Abstracts

Mikaela Algren and Grace Kerber

Ion reaction studies with a linear quadrupole trap (LQT)

Gustavus Adolphus College
Advisor: Dr. Jessie Petricka
3:10, NHS 121

Ions produced by laser ablation of solid strontium fluoride (SrF_2) are held together in a linear quadrupole trap to study the chemical reactions between the ablation products (e.g., Sr^+, SrF^+, and SrF_2^+). The linear quadrupole trap (LQT) uses an electrical field to restrict the motion of ions. After trapping for a given duration, a time of flight (ToF) mass spectrometer is used to determine the counts of each ablation product. Reaction rates between the products can be determined by modeling the ion concentrations over time. We found that the overall ion count decayed over time, but, under certain trapping conditions, specific species increased in count, indicating reactions were taking place.

Colleen Caldwell

Characterization of cadmium binding in Metalloprotein II

Gustavus Adolphus College
Advisor: Dr. Brandy Russell
4:05, NHS 105

Nereis diversicolor, a marine worm, is unique in its ability to survive in high concentrations of cadmium that would be lethal to other organisms. Investigation into this characteristic lead to the discovery of Metalloprotein II (MPII), a member of the myohemerythrin family. The affinity of MPII for cadmium makes it unique among highly similar proteins, making it an interesting model for protein-metal coordination. MPII for study was produced using *E. coli*, to which the MPII gene from *Nereis diversicolor* was transformed, and purifying the protein, which is initially bound to iron. The metal was removed from the protein, which was then reconstituted in the presence of cadmium, iron, or both. The binding was measured using UV-Vis and ICP-MS. Structural changes of the protein as bound to

iron or cadmium were determined through Native-PAGE electrophoresis. Our data suggests that MPII binds both iron and cadmium, with higher affinity for cadmium. Results from Native-Page suggest that MPII may have structural variation when it is bound to cadmium versus iron.

Amy Christiansen, Alexa Peterson, and Scott Anderson

Photodegradation of imidazolinone herbicides and pesticides

Gustavus Adolphus College
Advisor: Dr. Amanda Nienow
2:55, NHS 105

Imazapic, imazamox, imazaquin, and imazethapyr are herbicides commonly used on corn and soybean plants in the Midwest. Photolysis has been shown in previous studies of imidazolinone herbicides to be a major pathway of degradation in the environment. The purpose of this study was to determine the rate at which each herbicide degraded under different conditions and to propose photoproducts of the degradation. Two different systems were used for study: irradiation of the herbicides in aqueous solution as well as on the epicuticular waxes of corn and soybean leaves. Using ultraviolet light, these herbicides were irradiated at several pH values or at a constant pH with varying amounts of natural organic matter (NOM). The rates of degradation were analyzed using a high-performance liquid chromatograph (HPLC). To identify preliminary photoproducts, liquid chromatograph-mass spectrometer (LC-MS) data was used. Future work will include obtaining more data on the corn and soybean waxes, identifying photoproduct pathways, and observing how the herbicides degrade when analyzed on intact corn and soybean plant leaves. This summer, the researchers involved with the project travelled to Clermont-Ferrand, France, to collaborate with Dr. Claire Richard at the University of Blaise-Pascal.

John Danforth

Optimization of 2DLC conditions for separation of metabolites in* Brassica Napus *L.

Gustavus Adolphus College
Advisor: Dr. Dwight Stoll
2:30, NHS 105

Biomarkers are powerful tools in assessing the nature of environmental stimuli on organisms allowing for the study of diseases, infections or other effects on biological systems. In the study of glyphosate, the active chemical in Roundup®, the plant biomarker shikimate has been studied because glyphosate inhibits metabolic pathways that utilize shikimate and so the molecule builds up in the afflicted plant's system. Recent research conducted using ultra high performance liquid chromatography (UHPLC) as an analytical tool tried to determine if there were any other possible biomarkers present in a plant's metabolome that glyphosate might impact.

Our research focused on the separation of biomolecules found in canola (*Brassica napus* L.) treated with Roundup® utilizing two dimensional HPLC coupled with mass spectrometry (2DLC-MS) to optimize the separation. Up to this point a PFP column was used in the first dimension and a C18 column in the second as a trial column pair. A series of gradient analyses run in the second dimension have been tested and it appears that the varying ranges of mobile phase percentages have a distinct effect on the spreading of the peaks. A combination of these mobile phase conditions has the potential for increasing the efficiency of separations. Firmware issues and deciding how best to analyze collected data have slowed the progress of this research, but future work will entail continuing to manipulate gradient conditions and testing various column pairs.

Dominic Delmont

Taphonomy of bison bones from the Des Moines River

Gustavus Adolphus College
Advisor: Dr. Julie Bartley
2:30, NHS 121

Bison have been extinct in Minnesota before the 1850's. A recent discovery of a large number of bison bones in the Des Moines River near Jackson, MN raised questions about how these mammals became locally extinct and about the age and origin of these bones. Research last spring determined that the oldest bones were around 1000 years old, predating any European settlement in the area, with younger bones being around 200. In this project we wanted to know the transport history of bones in the river and determine whether humans butchered or killed the bison. To answer those questions, we collected additional bone material and performed a taphonomic evaluation, examining each bone for evidence of alteration by burial, transportation, or human modification. Several bones show evidence of butchering, mainly cut marks on ribs and long bones. Most bones showed a significant rounding and abrasion, which implies substantial time transporting in the river.

Andrea Gruver

***Population genetics of* Hyles lineata**

Chicago Botanic Garden
Advisor: Drs. Rick Overson and Tania Jogesh
3:50, NHS 201

Hyles lineata is the most widespread species of *Hyles* in North America, ranging from South America to Canada. *Hyles lineata* serves as an important pollinator for a wide range of plant species. The ability of the species to fly long distances allows them to transfer pollen between fragmented populations of plants, maintaining genetic diversity. To date, no population study of *Hyles lineata* been carried out in North America. In this study we amplified and sequenced 605bp of the mitochondrial gene Cytochrome Oxidase I (COI) to determine the extent of genetic structure within the species across the southwestern United States. Using 31 samples collected in the field combined with 9 South American samples obtained online from BOLD, 19 haplotypes were discovered; 15 of which were unique to a single individual, and 4 of which were shared across the sampled population. Haplotype A was the most widespread haplotype shared between 15 individuals, 14 from North America and 1 from Mexico. Haplotype B was shared between 5 individuals, 2 from North America, and 3 from South America and the Caribbean Islands. Geographical haplotype maps were created, as well as neighbor joining trees. The diversity and spread of haplotypes infers there are low levels of genetic structure within the species across the Americas, possibly resulting from high levels of gene flow between populations of *Hyles lineata* due to their long dispersal ability. In order to make any affirmative conclusion more samples are needed. We plan to collect samples from Arizona and New Mexico, as well as sequence 94 additional samples to add to the initial populations. These additional samples will allow us to draw conclusion regarding haplotype diversity and genetic structure of the species. This study has begun to explain the largely unknown population genetic structure of *Hyles lineata*. This information will be an important step in better understanding the evolutionary relationship between moth pollinators and their mutualistic relationships with plants.

Eric Hanson

Knots and links in the Newton-Leipnik attractor

Gustavus Adolphus College
Advisor: Dr. Tom LoFaro
3:50, NHS 121

In a system of three ordinary differential equations, a strange attractor is an attracting set that exhibits chaotic dynamics. The most famous and best understood strange attractor is the Lorenz Attractor. Within a strange attractor there exists an infinite number of periodic orbits; these orbits can be considered knots. The Newton-Leipnik differential equations exhibit chaotic dynamics and possess a pair of strange attractors. In order to analyze the knot-structure of each of the strange attractors, it is necessary to build a geometric model known as a template or knot-holder. We construct a single template that in some instances fits both of the strange attractors found in the Newton-Leipnik equations, suggesting that they are structurally equivalent. In addition, we show that this template contains the universal template of R. Ghrist and thus contains a copy of every knot.

Bailey Hilgren

Stromatolite vs. concretion: the origin of round objects in the Shakopee Formation

Gustavus Adolphus College
Advisor: Dr. Julie Bartley
2:55, NHS 121

The physical, chemical, and ecological conditions of early Earth can be reconstructed using records provided by geologic features. Two such features are stromatolites, which are limestone accretions formed by the interaction of microbes and sediment, and concretions, which are compact masses formed by mineral precipitation within spaces between sediment particles. Fieldwork investigating stromatolites within the Shakopee Formation in eastern Minnesota revealed the importance of distinguishing between stromatolites and concretions, as some concretions had been previously marked as stromatolites. It is important to make the distinction between these two structures because they were formed in different depositional environments and therefore point to different early Earth conditions.

Nathan Huber

Deposition of polymer films in a DC plasma

Gustavus Adolphus College
Advisor: Dr. Chuck Niederriter
4:35, NHS 105

Nathan Huber ('17) worked with Professor Charles Niederriter studying thin polymer film formation. The project goals were to better understand how these polymer films form, how to analyze surfaces on the micrometer scale, and how to create the films in a consistent manner. This presentation will introduce the process of depositing polymer films by way of a DC plasma, summarize the results from the research program, and cover future goals of this project.

Anna Huff

Microwave investigation of Xe-SO_3

University of Minnesota
Advisor: Dr. Ken Leopold
2:00, NHS 105

Intermolecular interactions are at the core of chemical processes, making their detailed characterization widely applicable to the fundamental understanding of various chemical systems. Microwave spectroscopy is a sensitive technique for gaining structural information which gives insight to the interactions in weakly bound clusters. This microwave study of Xe-SO_3 continues from a series of noble gas (Ng=Ar, Kr) complexes that involve a strong Lewis acid, SO_3, which plays a prominent role in the formation of atmospheric sulfuric acid. By utilizing both the broadband chirped-pulse and high resolution cavity components of a Fourier-transform microwave spectrometer, spectra were easily located and resolved for nine Xe-SO_3 isotopologues resulting in fitted rotational constants B, D_J, and D_{JK} for each complex. The nuclear quadrupole coupling constant, which depends on the electric field gradient at the Xe nucleus, was also determined for ^{131}Xe which has a nuclear spin of 3/2 and consequently exhibits hyperfine structure. As expected, the calculated Xe-S bond length is the largest of the Ng-SO_3 series as is the Xe-S stretching force constant. While this observation, along with a large electric field gradient at the Xe nucleus compared to Kr, might initially indicate more significant polarization of the Xe nucleus, prior work with Kr revealed electrostatic and charge transfer terms also contribute to the electric field gradient which prevents a direct relationship to polarization.

Michelle Hulke

Development of small,* PKD1*-specific amplicons to facilitate next-generation sequencing based molecular diagnostics of the duplicated* PKD1 *locus

Mayo Medical Clinic
Advisor: Dr. Peter Harris
4:05, NHS 201

Background: Autosomal dominant polycystic kidney disease (ADPKD) affects ~1 in 800 people and is caused by mutations to *PKD1* or *PKD2*. ~85% of genetically defined cases have mutations to *PKD1*. An intrachromosomal duplication of PKD1 exons 1-32 resulting in six pseudogenes with ~98% sequence identity to *PKD1* complicates ADPKD molecular testing. Current methods involving locus-specific long-range (LR) PCR followed by nested PCR and direct Sanger sequencing are time-consuming and risk missing mutations. The aim of this project was to amplify *PKD1* specifically as 300-400bp fragments to provide the foundation for a rapid one step NGS approach for molecular diagnostics of ADPKD.

Results: Primer pairs designed with a single nucleotide mismatch and variations of additional destabilizing mismatches between *PKD1* and the pseudogenes were tested to obtain locus-specific amplification of *PKD1* exons. The optimized amplicons were used to screen five families with atypical mutations identified from LR-PCR. Of three families with potential gene conversion mutations, two showed strong evidence consistent with a gene conversion, while one was negative. Proband III-1 (M639) had p.G2919R homozygously according to LR-PCR. Using the new method, the mutation was found to be heterozygous in III-1, consistent with possible allele dropout in the LR protocol. Previously, no mutation was detected in proband II-2 (M823), but screening of her affected son detected c.8970_8972delTTA. Our new analysis detected the deletion as a mosaic in II-2.

Conclusion: We have developed a methodology and demonstrated that we can specifically amplify *PKD1* exons from short amplicons. In 5 families tested, the new method helped resolve the etiology. The amplicons are ideal for multiplex-PCR applications such as Fluidigm, which can then be screened directly by NGS. This would allow rapid and sensitive ADPKD molecular diagnostics.

Brittany Knutson

Untitled

Gustavus Adolphus College
Advisor: Dr. Sun Hee Lee
4:20, NHS 121

Following the tragedy of September 11, 2001, Americans turned to writers of all kinds—journalists, poets, scholars and novelists—to make sense of the events. While journalists and poets contributed immediately, scholars and novelists took time to regroup, attempting to provide some profound insight on tragedy, grief and mourning. When they did produce, the American public criticized novelists, particularly, for failing to represent the unspeakable tragedy and the trauma that followed. Scholars commented on the prevalence of the traditional, nuclear family as a narrative trope in post-9/11 novels. Upon further analysis of criticism surrounding post-9/11 literature, creativity did not seem to be the only area lacking. The absence of female-authored 9/11 literature represented in critical texts was undeniable. However, further exploration into the post-9/11 genre revealed that women did, in fact, produce fiction following September 11 and they did so in far more creative ways. Through application of critical texts and intensive textual analysis, we conclude that female-authored 9/11 texts, though largely unexplored, employ female characters who explicitly use language in one form or another. As writers, linguists, and translators, they use language to interpret imaginatively the events surrounding 9/11 and translate between visual and linguistic worlds, past and present lives, Americans and Others, and the real and the symbolic realms. Far from being linguistically paralyzed, they deploy language to provide as sense of continuity and to make sense of collective American trauma.

Kory Kolis

***Investigating genes involved in pre-zygotic genetic isolation between* S. cerevisiae *and* S. uvarum**

University of Washington Seattle
Advisor: Dr. Maitreya Dunham
2:55, NHS 201

We come into contact with hybrid species everyday, from grapefruit to a lager beer. Hybrid species are common yet crucial in society. Hybrids are not just useful to eat or drink but also allow a unique insight into the evolutionary divergence between species. *S. cerevisiae* and *S. uvarum* diverged about 20 million years ago, and are still able to mate to form a hybrid. However when the hybrid cell goes through meiosis, the mismatched chromosomes are unable to separate properly and the cell arrests and dies. These hybrids therefore are essentially evolutionary dead ends, and it would beneficial for both the *S. uvarum* and *S. cerevisiae* to prevent interspecies mating. To search for genes involved in a possible mating barrier between the two yeast species I crossed wild-type *S. uvarum* to a knockout library of *S. cerevisiae* and measured the mating efficiency. I was able to gauge if the *S. cerevisiae* gene knocked out plays a role in the mating process by comparing the mating efficiency to the efficiency between wild-type *S. cerevisiae* and *S. uvarum*. Out of the approximately 400 genes of interest, I have currently screened close to 100 of them. There have been no fully characterized pre-zygotic barriers between *S. cerevisiae*

and *S. uvarum* yet, and if found, these barriers will shed light onto the genetic basis of evolutionary divergence between the two species.

Anna Krieger and Kristin Podratz

Protein unfolding

Gustavus Adolphus College
Advisor: Dr. Brandy Russell
4:20, NHS 105

A lot is known about what composes a protein, and how they work, but which transitional states they progress through to attain their folded states is still being investigated. The diverse folding and unfolding processes, once understood, can be applied everywhere from biomedical to industrial fields. The unfolding pattern of Myohemerythrin, an oxygen transport protein with a diiron center, was investigated in this study. Protein was exposed to a denaturant and the unfolding pattern was observed using fluorometry. The reduced form of the protein was observed using a similar protocol in an oxygen-free environment. It was determined that both the oxidized and reduced protein undergoes a two-step unfolding process. The purification process and fluorometry experiments were improved, the oxygen-free environment was established and protein was successfully reduced. Beginning steps were made in optimizing data gained from NMR experiments and mutagenesis of key structural amino acids was successful.

Russell Krueger and Rachel Mohr

The physical and biochemical alteration of the Platte River by* Phragmites australis*, an invasive species of wetland grass

Gustavus Adolphus College
Advisor: Dr. Laura Triplett
2:00, NHS 121

Invasive species can have a profound impact on the ecosystems to which they are introduced. Beginning in 2003, the Platte River, Nebraska, USA, was invaded by an aggressive species of wetland grass, *Phragmites australis*. The invasion by *Phragmites*, in combination with river flow reductions due to agricultural irrigation, has drastically altered the character and morphology of the river. Once a braided and largely unvegetated river, the Platte had become densely colonized with vegetation by 2010. We measured some physical and biochemical characteristics of Platte River sediments to infer how that vegetation has changed the system. Specifically, we measured particle size, which is an indicator of flow velocity, and biogenic silica (BSi), which is a critical source of silicon for some aquatic organisms. Sediment was collected from areas of the riverbed that are unvegetated, and from areas that are occupied by *Phragmites* or native vegetation. Particle size was measured using a laser diffractometer to determine how much fine particle deposition was occurring. Biogenic silica (BSi) concentrations were measured using timed NaOH digestions and inductively coupled plasma mass spectrometry (ICP-MS). Our results indicate that stands of *Phragmites* in the Platte River cause more deposition of finer silt-sized particles than other parts of the river that are unvegetated or are occupied by native vegetation. Also, *Phragmites* increased the sequestration of BSi in the river sediments. These changes to the Platte reverberate beyond the river itself; by sequestering silica in sediments, *Phragmites* could be diminishing the supply of silica to estuaries and coastal oceans. Hypothesizing that the silica content of the Platte's water had been reduced by the arrival of *Phragmites*, we measured dissolved (DSi) and biogenic silica (BSi) concentrations of Platte water using ICP-MS to compare to existing data from the 1990s.

Serenity Mahoney

Interpreting crater-related breccia in Endurance and Victoria Crater on Mars: a study of Martian sedimentary processes

Gustavus Adolphus College
Advisor: Dr. Julie Bartley
3:25, NHS 121

In planetary geology, it has long been understood that impact craters mark every solid surface on virtually every planet and satellite, not excluding the planet Mars. On Mars, impact sites are catalogued and analyzed by the rovers Spirit, Opportunity and Curiosity because the crater walls allow a limited view of Martian sediment and bedrock, a view not obtainable through surface imaging alone. Despite the usefulness of crater-related sediments, like breccias, in studying the water, past environments and evolutionary history of Mars, no database of the identifiable characteristics of crater-associated breccias exists. In this research, we constructed a method to analyze the characteristics of crater-associated breccias located in both Endurance crater and Victoria crater, and compared them to the characteristics of already identified breccias on Earth in order to imbibe the depositional and post-depositional environments that formed them. We expect these characteristics will be useful when identifying breccias on Mars, especially those altered by the presence of water and impact, continuing the interpretation of the history of Mars.

Sami Manick and Jens Thomsen

Food in the curricula

Gustavus Adolphus College
Advisor: Dr. Lisa Heldke
4:35, NHS 121

We conducted interviews with a number of professors concerning the use of food in their curricula. Our aim was to uncover the ways in which food is a quintessentially liberal arts topic. We also wanted to explore the alleged chasm between pre-professional majors and traditional liberal arts majors at Gustavus. In this presentation, we will delve into specific examples given by professors belonging to both pre-professional and traditional liberal arts disciplines that illustrate the effectiveness of food as a tool to achieve the desired outcomes of a liberal arts education. We found that food was an especially effective tool to achieve these outcomes regardless of the discipline to which the professors interviewed belonged.

Esther Mwangi

Mate discrimination by males (*bison bison*)

Gustavus Adolphus College
Advisor: Dr. Jon Grinnell
3:25, NHS 201

The purpose of this study was to determine whether American bison (*Bison bison*) males discriminated among females. Reported studies such as those of (Berger 1989; Bateson 1983; Ryan 1985) showed females mate selectively when males vary in quality because they invest more in offspring than males. However, I predicted that *Bison bison* males are discriminatory among females that vary in age and reproductive potential. To determine if *Bison bison* males discriminated between cows based on their reproductive potential or simply copulate with many females as possible I compared the percentage of tendings early and late in the rut between nulliparous cows and

cows that were older than 2 years old. I also compared if bulls selected cows with calves or cows without calves based on the average number of tending throughout the 2014 rut. Results showed higher ranking bulls (6-7 years old) selected cows older than 2 years old over nulliparous cows. Bulls of all ages were equally likely to tend nulliparous cows even though nulliparous cows entered pre-estrous early than cows older than 2 years old.

Josh Portner

Methylmercury photodemethylation

Gustavus Adolphus College
Advisor: Dr. Jeff Jeremiason
3:10, NHS 105

Methylmercury (MeHg) is known to bioaccumulate in natural ecosystems, most notably in fish. Demethylation of MeHg has been extensively studied, but the mechanism of demethylation is still under debate as recent publications have shown contradicting results. This study aims to gain more information on the demethylation mechanism by utilizing reactive oxygen species (ROS) quenchers. Preliminary results show that singlet oxygen ($^1O_2$) and triplet excited state dissolved organic matter ($^3DOM^*$) could be involved in the overall mechanism. Singlet oxygen is currently being studied by a generation experiment utilizing the disproportionation of hydrogen peroxide into water and singlet oxygen catalyzed by molybdate (MbO_4^{2-}). A method validation experiment with furfuryl alcohol (FFA) is being performed as FFA is known to degradate at a constant rate when exposed to singlet oxygen.

Lindsey Reiners

Untitled

Gustavus Adolphus College
Advisor: Dr. Julie Bartley
4:20, NHS 201

Kris Reiser and Rachel Weitz

Dragonfly larvae as bioindicators of MeHg in the St. Louis River watershed 2012-2014

Gustavus Adolphus College
Advisor: Dr. Jeff Jeremiason
3:25, NHS 105

Mercury is a neurotoxin that bioaccumulates across trophic levels and is detectable in dragonflies. Dragonfly larvae from several sites in the St. Louis River estuary were analyzed for total mercury and methylmercury and compared to water taken at the larvae collection site. Larvae were determined to be an accurate indicator of methylmercury concentrations in water. This project was a continuation of a two year monitoring of the St. Louis River watershed examining the impacts of sulfate loading.

Michaela Rice

What makes a happy home? Understanding western burrowing owl habitat and ecology

San Diego Zoo Global Institute of Conservation Research
Advisor: Dr. Lisa Nordstrom
3:10, NHS 201

This summer I conducted research with San Diego Zoo Global at the Institute of Conservation Research in San Diego, California. I conducted a project throughout 12 weeks researching Western burrowing owls in five sites in the Otay Mesa Region of Southern San Diego County; just north of the Mexican border. Western burrowing owls (WBUOW) have been declining in population size throughout their historic range over the last century due to urban encroachment and development. In response to the decline of the population, many management efforts have been put in place in the form of deploying artificial burrows throughout its range to provide burrows for WBUOW. However, no one has investigated the efficacy of this burrow placement. The purpose of my project was to characterize nesting habitat between 3 burrow types: naturally dug, wood artificial and plastic artificial to inform future management strategies. I used data from 2013 and 2014 to examine the number of fledglings for each burrow type to help explain productivity of each burrows. I also examined various explanatory variables for my fledgling response variable such as: microclimate, vegetative height, emergence date, and prey delivery data.

Beth Wiese

Epigenetic regulation of DNA methyltransferase 3-like (DNMT3L)

Mayo Graduate School
Advisor: Dr. Keith Robertson
3:50, NHS 105

Epigenetics refers to heritable changes in gene expression that are not due to changes in DNA sequence. DNA methylation via DNA methyltransferases (DNMTs) occurs at the 5 carbon of cytosine primarily within CpG dinucleotides. Due to aberrant DNA methylation observed in cancer cells, it is of interest to examine mechanisms that regulate DNA methylation. Within the DNMTs, DNMT1 is involved in maintenance methylation, DNMT3A and DNMT3B are involved in *de novo* methylation, and DNMT3L is believed to be important in facilitating *de novo* methylation through interactions with DNMT3A and DNMT3B. Because of the role of DNMT3L in facilitating *de novo* methylation, the objective of this project was to examine the mechanisms by which DNMT3L is regulated, and thus, a method in which DNA methylation is regulated. Using DNA epigenetic and histone epigenetic modifier knockout and knockdown derivatives of colorectal and embryonic carcinoma cell lines, the methylation status DNMT3L promoter and exon 5 was analyzed using bisulfite genomic sequencing and DNMT3L mRNA expression was analyzed using quantitative PCR. DNMT3L methylation and expression was found to be regulated by DNMTs, histone modifiers and ten eleven translocase (TET) enzymes. Future work will include the determination of methylation status at additional regions of DNMT3L and further analysis of the role of histone modifiers in regulating DNA methylation.

Joshua Wolanyk

Effects of an electric field on superfluid helium

University of Minnesota
Advisor: Dr. William Zimmerman
4:05, NHS 121

The effect of an electric field near the lambda point of liquid helium-4 is studied using sound resonance to determine the temperature of liquid helium. The resonance is measured in a 1.27 cm cell with the ends covered in 1 μm Nuclepore membrane. The membranes are individually used as either a transducer or receiver. The electric field is applied across the membrane by coating it in aluminum using vacuum evaporation. The temperature is then measured at three different voltages that create electric fields up to 10^7 V/m. Initial results show that there is a change in temperature has a non-linear relation to the electric field.
