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Welcome & Acknowledgements

Welcome to the fourth year of our Carroll College Student Undergraduate Research Festival. It is exciting to watch this event grow and to visibly demonstrate our support for undergraduate research as an important part of the Carroll experience. Today, we celebrate the research and hard work of our students under the guidance of their faculty mentors. This year, 65 student presentations and posters featuring a wide range of research subject matter across our academic disciplines will be showcased during the festival. Thank you for your willingness to share what you have learned. Thank you to the faculty members who nominate and mentor our students through their research experiences. You serve as role models for our students as they work towards future accomplishments in their chosen careers. I would also like to thank the collective efforts of: Dr. Brandon Sheafor and Dr. Jeannette Fregulia for their passion and enthusiasm to this Carroll tradition as well as their planning, guidance and commitment to the festival; Dr. Ryan Hallows and Dr. Eric Sullivan for their review of abstracts and commitment to the festival; Ms. Nona Keeler, Ms. Dayle Williams and the library staff for accommodating our needs for session space; Ms. Laura Ottoson for her creative and impeccable design and layout for this program; and Ms. Karen Bratlien for her coordination efforts with the event. This celebration of our students’ accomplishments exemplifies Carroll College’s motto—“Non Scholae Sed Vitae.”

Catherine Day, Associate Vice President of Academic Affairs
Carroll College
Research Festival
Schedule
April 28, 2015

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Sarah Fitzpatrick, Biology
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Paige Collick, Chemistry
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Nathan Bollar, Chemistry
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Melanie Vert, Sociology
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Chase Bell, Environmental Studies
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Session 1  Presentations, 1 to 1:45 p.m.

• 1A: TRINITY LOUNGE

Jay Bouchard, English
“Conscience is but a word that cowards use:” Richard III’s Machiavellian Ineptitude and its Political Implications

This thesis focuses on William Shakespeare’s play, Richard III and Niccolo Machiavelli’s political treatise, The Prince. This thesis begins by contextualizing the presence of Machiavelli’s work in Early Modern England. The first chapter of the work addresses the extent to which Shakespeare would have encountered Machiavelli before writing “Richard III”. The subsequent chapters then examine Richard III’s development as a “Machiavellian” ruler, and particularly how his political tactics align with those presented in Machiavelli’s The Prince. This thesis then argues that while Richard appears dramatically to audiences as a self-proclaimed Machiavellian villain, he ultimately fails to fulfill Machiavelli’s instructions and thus fails to maintain the power he has violently acquired. Richard employs cruelty irresponsibly and his conscience ultimately disrupts his ambitions and proves to be the most prominent factor that limits his ability to succeed as a Machiavellian prince. I argue that in rendering Richard’s failure to fulfill Machiavelli’s instructions, Shakespeare brings into question whether or not a purely Machiavellian ruler is a desirable or even practical possibility.

Meghan Benda, Chemistry
Synthesis of a Novel Blue Light-Emitter for Use in Organic Light Emitting Diodes (OLED’s)

OLED’s have the ability to produce large, flexible image displays that rival LED’s in efficiency and cost effectiveness. For OLED’s to produce a full color display, red, green, and blue light-emitters are needed, but the production of stable and efficient blue light-emitters has been problematic. The aim of this research is to synthesize a family of novel blue light-emitting molecules that demonstrate high stability and pure blue light emission. The parent molecule is comprised of three subunits: Diphenylacetylene (DPA), Carbazole, and a Dendron, each chosen specifically to ensure stability and effective blue light-emission. Each subunit has been individually synthesized and the terminal DPA subunit has been borylated in order to be coupled to the central carbazole subunit. The reaction conditions for the final Suzuki-Miyaura coupling reactions to complete the parent molecule are being investigated and optimized. Upon synthesis of the parent molecule, study of its light emitting and electronic properties as well as stability tests in solution and in thin film form will be performed.

Garrett Ryerson, Anthrozoology/Biology
An Analysis of Individual Reactions to Leashed and Unleashed Dogs

This research details the effects of off leash dogs on their human counterparts. The main issue that is being addressed is that of an individuals comfort levels around off leash dogs, and the various reactions and stresses that accompany one on an average walk up to Mt. Helena. Being an Anthrozoology student, interest in the different levels of comfort humans experience as a result of how the animal is presented (leashed or off leash) is fascinating and in need of further scientific research. Background information was obtained for this topic through the City of Helena website where leash laws and restrictions are stated for specific recreational centers around town. The survey process consisted of a sampling of a population on Mt. Helena (n = 51) and gauging the reactions on a continuous scale of 1-10 in regards
to their comfort level with the dogs leash status. While the hypothesis set for this experiment was that individuals that experienced the dog off leash would have a statistically significant difference in their response when compared to leashed dogs, the difference in response was marginal. The overall effect of the presence of a dog on a leash was found to alter the subject's response from that of a subject without one, but not significantly.

• 1B: SIMPERMAN 101

Jessica Knapp, Philosophy
An Investigation of the Self as Relational and the Propensity of Evil Produced from Indifference towards Human Relationships

Selfhood can be understood in many different ways. In this paper I demonstrate that selfhood understood by Søren Kierkegaard and Albert Camus provides an understanding of the human person that is isolated and disconnected from reality. Relying heavily on Hannah Arendt, I offer the alternative that an understanding of the self as relational leads to a more compelling understanding of the human person and reality. Once the self is understood as relational, I will then explore how an indifference towards human relationships leads to a higher propensity for evil.

Kaitlin Johnson, Mathematics
Analyzing Trends of Public Transportation for Optimal Routes in Helena, Montana

Currently, the Helena Area Transit System (HATS) serves as the primary source of public transportation in the city of Helena, Montana. The services offered by HATS include both a set route as well as curb-to-curb stops. With both programs in place, the routes taken each day by the bus are rather inefficient. In this presentation, I will describe my proposal for a new, set bus route which pushes to maximize ridership without increasing burden on the busses. Using historical data for curb-to-curb pick-ups and drop-offs, I will discuss the mathematical models that I developed in order to determine the optimal locations for bus stops. With those results, I will then expand on how I implemented methods of optimization in order to increase ridership.

Celena Alduenda, Elementary Education
Kaycee Brustkern, Health Science
Ashley-Ann Goddard, Business/Spanish
Characteristics of True Love

The topic of discussion is an examination of love from a philosophical perspective. Celena Alduenda will argue that “reciprocity” is an essential component of love relationships. Kaycee Brustkern will explore “reciprocity” as genuine and superficial, as well in the context of different kinds of relationship. Ashley-Ann Goddard will be discussing the concept of “equality” within a relationship. The presentation relies on the work of Plato, Aristotle, Kierkegaard, Wagoner, Irigaray, John Stuart Mill and Harriet Taylor.

• 1C: SIMPERMAN 231

Kacey Gollehon, Political Science/Communications
Cori Losing, Political Science
Independents as Partisans in Lewis and Clark County

Montana has a history of electing Democratic Senators while simultaneously voting for Republican Presidential candidates. The high rate of split ticket voting suggests that many Montanans are political
Independents. And indeed, politicians and scholars often describe the state as politically independent. ‘Pure Independents’ are voters who self-identify as Independents with no partisan preference. In addition, there are voters who are considered ‘closet partisans,’ who identify themselves as Independents but typically favor one party. We seek a better understanding of Montana’s self-described Independents. Our evidence comes from the 2014 Carroll College Exit Poll conducted in Lewis and Clark County, which provides evidence on ideology, candidate preference, and political party identification for 805 voters. Through our research, we provide statistical evidence to test the following two questions: Are Independent voters in Lewis and Clark County actually closet partisans? If so, what party do Independents in Lewis and Clark County tend to lean towards? We use the data to compare people who describe themselves as Democrats, Republicans, Independents, or as having no preference. The proportions of straight ticket versus split ticket voters are compared for each group. We find that a majority of self-identified Independents in Lewis and Clark County tend to lean towards the Democratic Party. We are also able to confirm that self-identified Independents frequently voted a strict party line, suggesting that many are closet partisans. We conclude by discussing the implications and limitations of our research.

Mark Barnett, Biology

**Exploring the Role of Dctn2 in the Trafficking of GluR2-Containing AMPA Receptors**

AMPA receptors are post synaptic receptors that play a role in thinking and learning. Although their function is understood, the method by which their trafficking in neurons is regulated remains unclear. The goal of my research was to determine whether Dynactin Subunit 2 (Dctn2) affects the trafficking of AMPA receptors through the regulation of the AMPA receptor subunit, GluR2. To accomplish this, Dctn2 was amplified via PCR, ligated into the mammalian expression vector pcDNA 3.1, and transfected into Human Embryonic Kidney (HEK) 293 cells, NT2 cells and neurons. Immunostainings and Co-immunoprecipitations were performed on the transfected cells to determine protein localization and if Dctn2 associated with GluR2. Unfortunately, the immunostainings and co-immunoprecipitation assays did not yield definitive results, thereby preventing a clear understanding of the role of Dctn2 in AMPA receptor trafficking.

Michelle Golden, English—Creative Writing

**Cutting the Corset Strings: Why Freeing the Female Body Frees the Female Mind**

Women today face impossible ideals; we have to be skinny, yet strong, forceful, yet demure, independent, yet focused on our families, with just the right amount of masculine know-how to get along with men, yet never enough to threaten their masculinity. This is constantly reinforced through the media. When we stand in line at the grocery store, magazines show beautiful women, usually in a bikini, telling us we can be 5’11” while weighing 99 pounds right after giving birth, while maintaining the husband, the children, the house, the career, the children’s potential sports stardom through relentless practices, the perfect body, and still have the energy to use the recommended 101 ways to satisfy your man in the bedroom. But do we ever stop to consider that this is all a distraction from what is really going on? That this ploy of distraction has been used before? In this paper, I will assert that the societal standard of beauty and the value of appearance, and the potential failure to meet this idealized standard, work as social controls to keep women from distinguishing their own identities outside the stylized feminine ideal, which, in turn, prevents women from coming together as a unified power that could wrest control of our society out of patriarchal control.
Alex Kastens, History


Examining the Cold War relationship between Denmark and the United States in the early years after WWII, 1947–1949, will show the reasons for U.S. involvement in the North Atlantic. This essay will contend that the United States used the Truman Doctrine, the supply of arms to its allies, and the expansion of the Cold War, to insist on a continued U.S. presence in the North Atlantic. This essay specifically details the importance of Greenland, which was controlled by the Danish, as a strategic military base for the U.S.

Sarah Jo Willcockson, Anthrozoology

**Dog and Pony Show**

The scientific evidence supporting certain foundational anthrozooligical assertions regarding the human-animal bond is inadequate to support the definitional human-animal bond phenomenon defined as a unique, bilateral benefit derived from interspecies interaction that is not and cannot be garnered from interaction with conspecifics (Fine & Beck, 2010). Various problems in human-animal interaction research are highlighted and analyzed, such as poor internal validity, lack of control groups, and various confounding variables. Further, the current parameters of human-animal interaction research, such as the de facto limitation to animal-human models, is questioned and analyzed in order to offer additional avenues of human-animal interaction research that could reduce the number of confounding variables. The primary research alternative offered is the use of animal-animal models to test effects of conspecifics, specifically the effects of interspecies interaction versus intraspecies interaction. In order to view animal-animal models as a viable research alternative, it is first necessary to understand the degree to which humans and animals are analogous. However, once understood, the possible introduction of animal-animal models could negate many of the confounds that currently detract from human-animal interaction research, such as non-randomized sampling and researcher expectations. Ultimately, this investigation raises questions about how and if research should continue to expostulate that animals can be used as proxy emotional models for both human-animal interaction research and as objects of anthropomorphism in therapeutic practice.

Kyle Willis, Math for Secondary Education

**The Game of Life: Classroom Gamification**

Can we enhance student learning by turning mathematical content into a game? The goal of the project is to create a long-term lesson out of The Game of Life. The lesson is built for an intermediate level high school math class and ties in multiple Common Core Standards. The basis of the game is to create a life-like environment in the class where students have jobs, insurance, and families, and have to pay taxes and do the everyday “adult” task. Our classroom game will be played out over the course of a term. The goal of the game is to teach high school students how post high school life works.
Session 2 Presentations, 2 to 2:45 p.m.

• 2A: TRINITY LOUNGE

Chase Farrell, Business
Matthew Kittel, Engineering
Ryan McCauley, Finance
Beaugh Meyer, Computer Information Systems
Christopher Michael, Engineering
Albert Michael Olszewski, Engineering

**Entrepreneurship in Action, a panel discussion**

A discussion panel of the Carroll College Entrepreneurship program and the student projects, their successes and failures, brought forth from the program.

• 2B: SIMPERMAN 101

Kathleen Schut, Environmental Science

**Fire History and Tree Growth Responses in the Tenmile South Watershed, Helena, MT**

The Tenmile South watershed, southwest of Helena, Montana, is the subject of a controversial fuel reduction project initiated by the community. Historic mining activities have resulted in heavy metal contaminated sediments in the upper watershed. These toxic sediments could be mobilized following a catastrophic fire and pose a risk to Helena’s water supply. Dead trees from beetle infestations in 2006-2009 now pose a significant fire hazard across the watershed. A proactive fuels reduction project has been proposed by the United States Forest Service (USFS) to reduce the risk of fire and potential impact on the water supply. Part of our study is a reconstruction of fire history that will be part of the environmental impact statement (EIS) being prepared by USFS. This is an important aspect in the project to strengthen the management plan and provide a better understanding of fire in the watershed for officials and locals. Cross-section ‘cookies’ and increment cores were obtained from fire scarred trees located across the watershed from five biophysical settings identified by the USFS (Arno & Sneck, 1977). Old growth ponderosa pine (*Pinus ponderosa*) and douglas firs (*Pseudotsuga menziesii*) with multiple fire scars were the primary targets for analysis, but a dominance of fire scarred beetle-killed lodgepole pine (*Pinus contorta*) comprise most of the data set. Preliminary assessment of fire scars suggests a fire return interval of 70 to 80 years from a record extending back to the early 1700s. Ring width measurements indicate that trees are responsive and that growth rates are correlative with climate drivers.

Bobbi Owen, Political Science

**Hobbes’ Critique of Religion: A Necessary Byproduct of the Modern Project?**

Though Thomas Hobbes’ *Leviathan* has been analyzed thoroughly by students of political theory, few scholars have examined his critique of religion and reinterpretation of scripture, which occurs in Part III of his work. Scholars who have attempted to analyze his critique do not agree about what he intended to accomplish with this reinterpretation. Some scholars claim that Hobbes’ reinterpretation is merely subversive; others have noted that Hobbes did not deny completely the existence of a god; finally, many have noted that Hobbes merely critiqued religion in order to ensure that it would not damage his political
and scientific projects. While there is evidence in the text to support all of these claims, this thesis will aid in closing a gap within the literature by offering a more thorough exegetical analysis of the Part III, chapter 42, entitled “Of Ecclesiastical Power”. Through a textual analysis of Hobbes’ most substantive condemnation of religion and the Catholic Church, this thesis will examine the factors that led Hobbes to offer a radical reinterpretation of scripture.

Colin Gunstream, Political Science

Home Rule or Rome Rule? The Decision in Congress to Cut Funding for Indian Sectarian Schools and Its Implications on Montana

In the mid 1800's, Catholic Missions settled in Montana and sought to evangelize Native Americans. During this time, Catholic schools were established and became the predominant mode of education for Native Americans. The schools relied heavily on financing from the Federal government. A decision was made to cut funding from these schools between 1896-1900 in which all of the Mission schools in Montana either closed or lost their significance. This thesis analyzes the different modes of thought in Congress and in interest groups between 1890–1900. This thesis argues that the National League for the Protection of American Institutions, a small but significant interest group in New York was widely responsible for this change in policy and in thought both in Congress and in State legislatures. Lastly, this thesis employs Punctuated Equilibrium theory.

Virginia Davis, Business Administration

Why is there a lack of attendance at Carroll Athletic Events?

The research that will be conducted will answer the question: do you think there is a reason for why your fellow students do not attended Carroll athletic sporting events? Finding the answer as to why students at Carroll College do not attend athletic sporting events is the main objective. Many factors that could be affecting students’ abilities to attend the sporting events will be explored. To find the answer to the objective, a survey sampled 204 current students at Carroll College. The survey was administered by email to 1,559 current students. The students could then take the survey if they desired. There were ten questions to be answered by the student. The answers this survey provided were used to fully understand how many games students went to, what was the underlying reason that kept students away from sporting events, and if they would attend games for soccer and softball. The results showed strong reasons as to why students do not have a high attendance record at Carroll sporting events and which sports have the greatest attendance. There was a clear answer for each of the questions that were analyzed, showing that Carroll students have an unmistakable knowledge of what they like and what they want out of sporting events. The most concerning limitation of the research would consist of the students misunderstanding the questions being asked, which would result in answers that do not satisfy the question correctly. Other shortcomings that could show up are in the calculations of the results.

Jay Bouchard, English

“I don’t give a damn for your power:!” The Reversal of Power Structures in Aimé Césaire’s A Tempest

This paper analyzes the manner in which William Shakespeare’s The Tempest and Aime Césaire’s A Tempest differ, especially in their treatment of the character Caliban. Caliban’s character plays a much more prominent role in Césaire’s work than in Shakespeare’s. While Caliban is a central character in The Tempest, Prospero is the most dominant and powerful figure in the play. In Césaire’s rewriting, Caliban is featured more prominently. For example, Caliban controls a greater percentage of the play’s dialogue. This paper argues that in Césaire’s post-colonial rewriting, he presents Caliban as the protagonist
of the play and presents Prospero as the antagonist. The audience (or reader) of this play is inclined to sympathize with Caliban’s plight and comes to see Prospero as an unjustified colonizer inhibiting Caliban’s chances to be free. The paper relies on both primary and secondary source material in order to prove that Césaire’s work is a form of resistance to Shakespeare’s Early-Modern play. This paper also contextualizes the historical and political environment in which Césaire wrote A Tempest. Césaire was affiliated with the anti-colonial and pan-African Negritude movements and this paper sets out to demonstrate how his political preferences influenced his work.

Dustin Williams, Chemistry

Investigation of a Cycloaromatization Reaction Initiated by a [1,7]-H Shift

A mechanistic study of the cycloaromatization of 1-(1Z)-1-propen-1-yl-2-(2-trimethylsilylethynyl)-benzene to 1-(trimethylsilylmethyl)-naphthalene was conducted. This mechanism is believed to be initiated by a [1,7]-H shift. The research includes the synthesis of the model cycloaromatization substrate for the study. The synthetic route involves a Sonogashira coupling to form 2-(2-trimethylsilylethynyl)-benzaldehyde from bromobenzaldehyde followed by a Wittig reaction to form the desired substrate.

2D: LIBRARY, SAGE ROOM

Seth Dotson, Biochemistry/Molecular Biology

Population Genetics of the Tick, Dermacentor andersoni, in Montana Based on the Mitochondrial 16S Gene

The ticks Dermacentor andersoni are vectors for Colorado Tick Fever, Rocky Mountain Spotted Fever, Powassan encephalitis, and Bovine anaplasmosis. Under the Infectious Disease Ecology Research Program at Carroll College, the protocols for developing a West Nile Virus distribution map are being applied to D. andersoni. A portion of the 16s ribosomal mtDNA was PCR amplified using the D16S5 and 16S+1 primers for 105 D. andersoni spread between five sites in western Montana. There were nine different haplotypes found in this study. This is lower than the 14 reported haplotypes found in a similar study done near Lake Como in Montana. The statistical analysis indicated there was no statistical difference between the populations.

Veronica Jones, History

Queen Isabel, Conversos, and Radical Catholicism

For centuries historians have worked to understand the Spanish Inquisition. There have been countless arguments regarding the primary force behind this event, but none are considered guiltier than Queen Isabel. This paper and presentation examine the conflict present in Spain during the 13th and 14th centuries, primarily between the three Abrahamic faiths. The argument is that Queen Isabel, with the complicity of the papacy, used a radical interpretation of Catholic teaching to rationalize her persecutions of the converso population in Spain.

Jessica Bauer, Math
Sarah Fitzpatrick, Biology
Austin Powell, Mathematics/Physics

Searching for the Lost

Every day, thousands of individuals use an airplane to get from “Point A” to “Point B”. In the past year, two of the largest types of transcontinental planes have gone missing, almost without a trace. Many of the problems for finding an airplane rest in the communication system between the control tower and
the plane once it comes into range. Unfortunately, all communication is lost between the two when a plane reaches a short distance off shore. We constructed a search area which is defined by the maximum amount of area the plane could have traveled as a function of the amount of fuel in the plane. This area was cut into separate sectors, which were designated different priorities depending on probable areas in which the plane could be. Highest priority was designated along the flight path, while lower priorities were assigned due to currents and wind. Then, our non-linear program optimized the search pattern based on the number and parameters of the search resources provided by minimizing the time that each search craft takes to explore its sectors. We designated high priority areas in our non-linear program to be searched first, followed by the lower priorities in descending order. Our non-linear program took into account the different possible search vessels’ velocities, refueling needs, as well as the time it takes to refuel and the probabilities for where the plane will most likely be. Each of our search assets traveled in a cross-grain pattern so that every sector was efficiently searched. Our final model is versatile and adaptable to any emergency situation.
Stephen Schmidt, Chemistry

**Adsorption of Human Hemoglobin onto Chitin and Cellulose Surfaces**

The adsorption of hemoglobin onto chitin and cellulose has yet to be modeled. In this work, hemoglobin solutions were prepared in 50 mM, pH = 7.4 phosphate buffer at concentrations of 0.0125 – 0.5 mg/ml and adsorption onto gold, chitin, and cellulose surfaces was studied with surface plasmon resonance (SPR). First, chitin and cellulose were modified with trimethylsilyl groups to improve solubility in common organic solvents. Solutions with concentrations of 0.05 mg/ml were prepared (in chloroform for chitin and toluene for cellulose) for the purpose of preparing spincoated films. Polymer films were spincoated onto gold SPR surfaces, and the hydroxyl groups were regenerated using 10% aq. hydrochloric acid vapor. Hemoglobin solutions were streamed across gold, chitin, and cellulose surfaces and resonant angle changes from SPR were converted into surface concentrations ($\Gamma_{SPR}$). In all systems, hemoglobin failed to cover the entire surface, therefore equilibrium $\Gamma_{SPR}$ were less than a monolayer. Hemoglobin adsorbed onto gold surfaces with $\Gamma_{SPR}$ = 1.2 mg∙m⁻² and reached equilibrium within 70 min, independent of hemoglobin concentration. Hemoglobin adsorbed faster onto gold than chitin, however $\Gamma_{SPR}$ for adsorption onto chitin exceeded gold at high solution concentrations. For cellulose surfaces, hemoglobin adsorption led to smaller $\Gamma_{SPR}$ at all concentrations tested relative to chitin. Adsorption rates for hemoglobin adsorption onto cellulose were substantially smaller than those observed with gold and chitin. These studies revealed stronger interactions between hemoglobin and chitin than hemoglobin and cellulose that are consistent with strong interactions seen between hemoglobin and chitosan derivatives used in drug delivery formulations.

Sarah Roshak, Mathematics

**An Analysis of Functional Expenses at the United Way of the Lewis and Clark Area**

There is very little data regarding how nonprofit organizations distribute their expenses among programs, management, and fundraising. As a service to the United Way of the Lewis and Clark Area, we analyzed the organization's Statements of Functional Expenses from historical IRS Form 990 documents. The analysis determined trends in how the organization distributed past expenses among the three expense categories of the Form 990. These trends were compared to other United Way organizations as well as a broad range of nonprofit organizations within the United States. The purpose of such comparison was to determine how much of the United Way of the Lewis and Clark Area's total expenses are dispersed towards fundraising in comparison with other nonprofit organizations. The end result of our analysis was a spreadsheet that the United Way of the Lewis and Clark Area's new Executive Director can use as a guide for future expense distribution.

Sean Condon, Biology

**Associations Between Large Mammal Abundance, Elevation, and Tick Capture Rate in the Big Belt Mountains**

The Rocky Mountain wood tick, *Dermacentor andersoni*, is the primary tick vector of the human pathogens Rocky Mountain spotted fever and Colorado tick fever in the Rocky Mountain Region. Drag sampling was conducted to investigate the association between large mammal abundance, elevation, and tick capture rate in the Big Belt Mountains near Helena, Montana, during suspected peak tick activity in May and June of 2014. Soil temperature and type, climate, humidity, aspect, slope, and the availability of hosts have been shown to be factors that determine tick distribution. Multiple factor regression,
using elevation as a covariate, found that even after accounting for elevation, the relative large mammal abundance was significantly negatively associated with the number of ticks observed per hour. It seems likely that overgrazing by large mammals, such as deer and elk, causes a trophic cascade that negatively affects small mammals and tick populations, due to a lack of vegetation. The majority of observed ticks were found at elevations between 1323-1761 m. It is unclear exactly why the majority of ticks are found within a specific elevation range, but it may be due to climatic factors like average daily maximum temperature and humidity.

Sarah Fitzpatrick, Biology

Comparison of West Nile Virus infection Rates in Culex tarsalis and Horses in Montana using RT-PCR and ELISA

Horses are more susceptible to West Nile virus than human beings. In addition, for many ranchers in Montana, horses are their livelihood. In Montana, the only risk assessment tool for WNV is mosquito surveying. Testing horses across the state for WNV may contribute to a better estimate of high-risk areas. Also, since the numbers of human and horse cases are similar on a yearly basis, testing horses may predict the human risk. In this study, C. tarsalis infection rates were compared with horse infection rates in Montana. Mosquitoes were collected from 146 sites across Montana on a weekly or biweekly basis. Collected mosquitoes were sorted, homogenized, and run through an RNA-extraction. WNV in mosquitoes was detected using RT-PCR. Horse serum was collected from the Helena area and analyzed for NS1 and envelope IgM and IgG antibodies to determine WNV exposure and/or vaccination. Three counties had positive C. tarsalis pools for WNV. Two unvaccinated horses had positive IgM WNV antibodies. However, due to borderline results and vaccination contamination a horse infection rate could not be calculated to make a comparison with the mosquito vector infection rate. Since horse positives occurred in an area where no positive pools were found, horse surveillance may be critical for detecting WNV hot zones.

Victoria Kong, Chemistry

Developing and Applying New Thin Film Combinatorial Techniques for the Discovery of New Metal Oxide Semiconductors for the Efficient Photoelectrolysis of Water

One of the most promising sources of renewable energy is solar powered water photoelectrolysis in which energy from sunlight is stored within a chemical bond of hydrogen (H2) and oxygen (O2). Recently, we have developed a new combinatorial metal oxide semiconductor thin film synthesis technique to aid in the discovery of new photoelectrolysis materials. The technique reproducibly generates high quality continuous gradient semiconductor films through the use of a screen-printing technique. This screen-printing technique is a cost and time-efficient method of creating a ternary phase diagrams that contain every possible three constituent alloy combination of the metal oxide. The metal oxide thin films are screened for potential photo-activity using the Solar Hydrogen Research Activity Kit (SHArK). The screen-printing technique and recently discovered photoelectrolysis semiconductors will be discussed.

Paige Collick, Chemistry

Electrochemical Determination of the Diffusion Constant of Ferrocene in Various Micellar Solutions

A series of micelles were made and examined to find the diffusion coefficient of ferrocene. The micellar media only worked if the acid could make a surfactant; some acids with long carbon chains cannot do this. The diffusion coefficient was found three different ways: 1) using cyclic voltammetry, 2) using chronocoulometry, and 3) using a series of compounds with varying hydrodynamic radii. It was found through cyclic voltammetry that as the scan rate increased the diffusion coefficient of ferrocene
increased. The varying hydrodynamic radii suggested that the longer the carbon chain, the lower the diffusion constant, or the slower it takes ferrocene to move through the surfactant.

Jessica Baker, Chemistry

Electron Withdrawing Catalytic Effects of ɳ5-Cyclopentadienyl (Cp) Ruthenium Complexes

This research investigated the uses of ɳ5-cyclopentadienyl (Cp) ruthenium complexes as electron withdrawing groups attached to dienophiles in a Diels-Alder (DA) reaction. Ethyl trans-cinnamate was synthesized from cinnamic acid and then refluxed with 2,3-dimethyl-1,3-butadiene. Ethyl trans-cinnamate was then complexed with a Cp*Ru+ fragment and refluxed with 2,3-dimethyl-1,3-butadiene. The results were studied by 1H NMR and GC-MS to determine if the Cp*Ru+ complexed ethyl trans-cinnamate was more reactive than the non-complexed starting material. The kinetics of the two reactions were then observed and catalogued.

Dustin Williams, Chemistry

Epoxidation Kinetics

A kinetic study of the epoxidation of cyclohexene to 1,2-Epoxycyclohexane. The reaction was monitored by FT-IR spectroscopy by investigating the growth and decline of peaks at various frequencies. By changing the concentration of one of the reactants (hydrogen peroxide) we had the ability to observe different rates of reaction.

Ariel Tange, Psychology/Community Health

Helping Behaviors Towards Individuals with Physical Disabilities and Individuals with Intellectual Disabilities

Weiner, Perry, and Manuson (1988) found that in situations where help is needed, pity and positive social responses or prosocial behaviors, will be generated if low ability is perceived. It has also been demonstrated that individuals with physical (IPD) and intellectual disabilities (IID), such as blindness and Down Syndrome, are often associated with low ability (Fiske, Cuddy, Glick, & Xu, (2002). Therefore, because individuals with disabilities are perceived as having lower ability, they may be more likely to receive help than those without disabilities. The purpose of this study was to better understand and to address discrimination towards IPDs and IIDs in emergency and non-emergency situations. Participants read vignettes describing emergency (i.e., person fell on ice) or non-emergency (i.e., person dropped money) situations with IPDs, IIDs, or no disability; they then reported their feelings about the situation and the likelihood that they would help. Participants were more likely to notice a situation when it was an emergency, and were more likely to notice that the IPDs and IIDs needed help compared to the control. Participants were more likely to interpret an event as an emergency when the subject was an IPD than an IID. Lastly, participants showed greater concern for individuals in the emergency situation and for IPDs as opposed to the control. In alignment with Weiner et al. (1988), our study demonstrated that individuals are more likely to demonstrate prosocial behaviors in situations where those with low ability (i.e., disabilities) need assistance; because those with disabilities are perceived as not being able to help themselves, people reported greater attention to their situation and more concern for those with various disabilities.
Catherine Stophlet, Health Science

**Identification of Current HCV Cases and Promotion of Efficient RNA testing and Improvement of Reporting**

Hepatitis C virus (HCV) is a blood-borne pathogen. Up to 80% of those with acute infection are asymptomatic; however, prolonged infections can lead to cirrhosis and hepatic cancer. In Montana, healthcare providers are required to report acute and chronic HCV infections to the Montana Department of Public Health and Human Services (DPHHS). Deficiencies in HCV testing and reporting make differentiation between current and resolved infections difficult. HCV RNA testing is required to detect currently infected persons. The objective of this investigation was to characterize the proportion of cases of HCV infection reported to DPHHS in 2013 who are currently infected and likely require treatment. HCV cases reported from 1,204 healthcare facilities were characterized as confirmed, probable, or suspect. Confirmed cases were defined by a positive antibody test or positive RNA test result. Probable cases were defined by a positive antibody test result and no RNA test result. Those considered suspect cases were resolved with no RNA test. A descriptive epidemiologic analysis was performed. During 2013, 1,294 HCV cases were reported. Of those, 1,118 (86%) were confirmed, 447 (35%) were probable, and 137 (11%) were suspect. Of reported cases, only 798 (62%) cases were tested by RNA testing. Of the 918 cases associated with an antibody test, only 471 (51%) cases had a follow-up RNA test. Of the total cases, 1,294 (56%) were male with more current, chronic, or resolved HCV infection cases occurring in the birth cohort after 1965, with a heavy occurrence in the birth cohort of 1945-1965. By using RNA testing, healthcare providers can identify persons currently infected with HCV. Reporting of HCV RNA test results allows for a more accurate description of HCV infection prevalence in Montana and identify persons in need of treatment. Earlier detection of current HCV infection might help reduce HCV viral load, improve clinical outcomes through effective treatment, and prevent further transmission of HCV. Healthcare providers should be knowledgeable of the need for HCV RNA testing in patients with prior HCV infection and the need to report HCV RNA results to DPHHS.

Alexis J. Smith, Health Science

**Increases in Montana Infancy Immunization Rates**

Immunizations are a vital part of preventing the spread of vaccine-preventable diseases. Ensuring each child is vaccinated per the recommended schedule decreases the risk of disease transmission. Children are more susceptible to diseases because of their underdeveloped immune systems and being in close contact with many other children. This study investigated the percentage of children, reported by medical professionals using Montana's Immunization Information System (IIS) and aged 19–35 months who were considered up-to-date with the Advisory Committee on Immunization Practices (ACIP) recommended schedule of 4 doses of diphtheria, tetanus, and pertussis vaccine (DTaP); 3 doses of poliovirus vaccine (IPV); 1 dose of measles, mumps, and rubella vaccine (MMR); 4 doses of Haemophilus influenzae type b vaccine (Hib); 3 doses of hepatitis B vaccine (HepB); 1 dose of varicella vaccine (Var); and 4 doses of pneumococcal vaccine (PCV). Data were taken from CoCASA clinic summary reports from Montana's IIS, imMTrax. For each clinic, the percentage of infants considered up-to-date was determined by assessing the proportion of children which received vaccines divided by the total number of children assessed from that clinic. Children deemed not up-to-date were those who missed an opportunity to receive a recommended vaccine, or children who are eligible to receive the next vaccine in the schedule but have not been back to the clinic. Clinic coverage rates were analyzed by county and health planning region. From the 1st quarter of 2012 to the 4th quarter of 2014 statewide immunization rates for the complete schedule were up 15%. Southwestern Montana has been lower than the average but also has seen an increase of nearly 30%, whereas northwestern Montana has seen no overall change in immunization rates. All clinics where vaccines are administered should use Montana's IIS and actively communicate the need for parents to have their children vaccinated. Research into why parents are not vaccinating their children would help to understand the differences in rates further.
Matthew Rosman, Chemistry

Inversion Magnetization Transfer NMR using N-acetyl-4-fluoro-L-proline-O-methyl-ester

It is difficult to determine the mechanism for protein folding. This experiment explores the potential of inversion magnetization transfer NMR with N-acetyl-3-fluoro-L-proline-O-methyl-ester (3F-Pro) for folding determination. Because of 3F-Pro's potential as a probe for protein folding, it is also an attractive compound for NMR analysis. Kinetic and thermodynamic analysis of 3F-Pro via inversion NMR will be discussed. By determining these properties some difficulties associated with protein folding analysis may be circumvented.

Caroline Cardenas, Biology

Investigating the Role of Olfm1 in the Trafficking of GluR2-containing AMPAR receptors

Neurons have the ability to either increase or decrease the strength of their connections with other neurons. This property is known as synaptic plasticity and is thought to influence higher cognitive functions such as learning and memory. Decreases in cognitive abilities as well as neurological disorders can be attributed to decreased synaptic plasticity. The variable expression of GluR2-containing AMPARs has been linked to changes in synaptic plasticity. The mechanism governing the trafficking of GluR2-containing AMPARs to synapses is not fully understood and was the main focus of my study. I hypothesized that Olfm1 (Olfactomedin 1) plays a key role in the trafficking of GluR2-containing AMPARs to the synapse. HA-tagged Olfm1 was successfully cloned into the mammalian expression vector pcDNA3.1. Western blot analysis verified Olfm1 protein expression in both transfected HEK293 cells as well as endogenous expression in NT2 neurons. GluR2-GFP protein expression was seen in transfected HEK293 cells, but we were unable to confirm endogenous expression in the NT2 neuron cultures. Co-immunoprecipitation experiments were also performed to study the interaction of Olfm1 and GluR2, but the tests remain inconclusive. Therefore, further testing is needed in order to accept or reject my hypothesis that Olfm1 plays a role in the trafficking of GluR2-containing AMPARs.

Patrick Zepeda, Chemistry

Oxidative Dimerization of 2-(1-Pyrenyl)Thiophene

In this experiment 2-(1-pyrenyl)thiophene was synthesized via a Suzuki cross coupling reaction of 2-bromothiophene and 1-pyrenylboronic acid. We then attempted to get the resulting compound to undergo oxidative dimerization via chemical and electrochemical pathways. Upon successful dimerization via an electrochemical pathway, photoelectric dimerization will be attempted on house made TiO2 mesoporous films.

Megan Arant, Anthrozoology

Przewalski’s Wild Horse

The Przewalski’s Wild Horse is the only surviving subspecies of wild horse. The horses are a highly social species and their native land is the steppes area around Mongolia and China. The Przewalski’s Wild Horse received its namesake from Russian explorer Nikolai Przhevalsky in the 19th century. These horses are unique in that they were considered to be extinct in the wild from 1960 to 2008. The horses’ decline was due to several factors including hunting, habitat loss, harsh climate, and loss of water sources to farm animals. However, there are breeding programs that have been put in place in zoos that are helping to recover the lost population. When the first breeding programs were put in place, the Przewalski's Wild Horses' gene pool suffered, as breeding was mostly between relatives. Nowadays, careful breeding along with the reintroduction of the horses to native lands are helping the horses make
a slow and steady comeback. The Przewalski’s Wild Horse is currently rated as critically endangered. The released individuals are tracked and monitored so success can be recorded. The Przewalski’s Wild Horse is a unique case because human intervention is helping in their recovery, rather than endangering them further.

*Nathan Bollar, Chemistry*

**Synthesis of a Diboronic Acid Thiophene for Implementation in Solar Panels**

Boronic acids are useful molecules for synthetic chemistry. The molecule being studied will eventually be used to perform a Suzuki Coupling Reaction to create a large molecule with a large, conjugated pi-electron system. Conjugated systems are useful for absorbing and storing light energy. The major problem in making this molecule is the initial synthesis of the diboronic acid thiophene, as diboronic acids are exceptionally difficult to synthesize. This poster will explore the progress made in synthesizing the diboronic acid required for the following steps of synthesis.

*Meghan Benda, Chemistry*

**Synthesis of L-Menthyl Anthranilate Via a One-Pot Transesterification Reaction**

Minute changes to the structure of esters can cause appreciably different properties to these substances. The transformation of methyl anthranilate to L-menthyl anthranilate via transesterification was tracked using fragrance changes and NMR analysis. The transesterification was accomplished using a simultaneous reflux and distillation method allowing the alcohol to escape as it was produced. The use of Le Chatelier principles combined with the correct catalyst ratio formed the desired ester in the greatest yield.

*Tarryn Vavruska, Mathematics/Biology*

**Turing Patterns and Butterfly Wings**

Butterfly wings consist of many patterns and every species has its own combination of patterns to make their wings unique. However, every possible pattern is derived from a common blueprint called a nymphalid groundplan. The cells of butterfly wings each emit a color either through the cell’s structure or through pigments that the cell produces. These cells must therefore work together in order to arrange themselves into the many patterns we see in butterfly wings. As the wings are developing, signals are distributed throughout the cells of the wings. These signals induce the cells of the wings to emit their designated color. In 1952, the mathematician Alan Turing devised a method to model the formation of patterns in nature using reaction-diffusion mechanisms. Turing named the cell signals morphogens and believed that these morphogens diffused through the cells of the organisms, inducing pigmentation and forming patterns. Using Turing’s methods along with more recently developed numerical methods for solving partial differential equations, the formation of the many patterns found on butterfly wings can be simulated. In this project, a small region of a butterfly wing was modeled using a system of two morphogens over a two-dimensional trapezoidal surface. This region included an eyespot from which it was assumed one of the morphogens was emitted. After solving this system using the Finite Element Method, a banded pattern emerged over the region. Therefore, repeating this process for the different regions of the wing can reproduce a pattern commonly found on butterflies.

*Melanie Vert, Sociology*

**Why is There Discrimination in Helping Situations?: The Effects of Negative Affect and Prejudice in Emergency and Nonemergency Interracial Helping Situations**

Kunstman and Plant (2008) found whites provided faster, better quality help to whites than blacks in emergencies, and suggested these differences may be due to affective responses to the emergency
situation rather than not racism toward the individual. We conducted a study to test their suggestion that negative affect, not racism, predicts discrimination in helping situations. White participants (N = 131) completed racism measures, read vignettes about white or black persons in higher (i.e., help with a car) or lower (i.e., help in a math course) emergency helping situations, reported their feelings about the situation, and indicated the likelihood that they would help and actively help the person in the situation. Other variables taken into consideration include higher and lower opportunities to justify not helping due to external factors (e.g., not having the time or knowledge to help), participants’ levels of trait empathy, participants’ motivation to present themselves in a socially desirable way, and demographic information. As predicted, we found that in higher but not lower emergency situations, individuals experiencing greater negative affect about the situation were less likely to help and actively help blacks but emotions did not influence helping whites. Racism did not predict differences in helping whites and blacks. Consistent with Kunstman and Plant’s suggestion and the arousal: cost-reward model of helping (Piliavin, Rodin, & Piliavin, 1969) in emergencies there is less time to think, which means participants react based on their emotions rather than cognitions. These results have implications for emergencies, such as natural disasters and car crashes.

Clara Thorsen, Anthrozoology

Xoloitzcuintli

The name is pronounced sholo-eats-queen-tli. They are also known as the Mexican Hairless dog. As the name implies, the Xolo is native to Mexico and Central America. This breed is one of the oldest dog breeds, dating back to when humans first entered the Americas. Xolos were sacred to the Aztecs and viewed as healers. Statues depicting them have been found in Aztec ruins dating back 3000 years. Sizes of the dog vary greatly. The weight of this dog ranges from 10 to 50 pounds, and heights of 10 to 23 inches. Despite the name, they are not always hairless. They are known as a natural breed. According to scientific and historical evidence, humans had very little interference with their breeding. However, it is unclear how much humans encouraged hairlessness in the breed.

Chase Bell, Environmental Studies
Patrick Dillman, Environmental Studies
Logan Franco da Silveria, Environmental Studies
Cole Fuhrman, Environmental Studies
Katherine Gilder, Environmental Studies
Michael Jones, Environmental Studies
Kathleen Schut, Environmental Studies

Field Reconnaissance Investigation to Explain Elevated Arsenic and Nitrates in the Raven Road Area, Helena, Montana

An applied field problem was conducted by the spring 2015 Environmental Studies Methods class (ES 304) in collaboration with Lewis & Clark County (L&CC) and the Department of Environmental Quality (DEQ) in the Raven Road area of Helena, Montana. Elevated nitrates (NO3-) above the maximum contaminant level (MCL) of 10 mg/L were observed in water-quality samples collected from wells in the area. In addition, elevated Arsenic (As) levels above the maximum contaminant level (MCL) of 10 μg/L were also observed. Carroll students were given the opportunity to measure water levels in residential wells, collect water samples, and evaluate the geology and hydrogeology of the immediate area to determine whether sources for the nitrates or arsenic could be identified. The field investigations and sampling events were conducted in March 2015 and the results of water analyses will be used to map concentrations of nitrates and arsenic. Subsurface geology and faults were plotted on cross-sections using well-log data. The water table surface was mapped using static water level in tested wells. Results of this study will be used by DEQ, L&CC and residents to make decisions about resolving water-quality concerns. Funding for water analyses were provided by the local agencies.
• 4A: SIMPERMAN 101

Blake Jordan, Biology

The Carrier Rate of Colorado Tick Fever in the Rocky Mountain Wood Tick, *Dermacentor andersoni*

The adult Rocky Mountain Wood Tick, *Dermacentor andersoni*, is capable of transmitting several diseases to humans, among these is Colorado Tick Fever (CTF). The abundance and distribution of the virus that causes this disease is largely unknown. Ticks were collected at multiple sites in Western Montana using drag sampling methods in order to test my hypothesis that the carrier rate of CTF was within the range of previous studies. The collected ticks were tested for CTF by extracting the RNA they contained, converting this RNA to DNA and amplifying it using reverse transcriptase PCR. This product was then run out on an agarose gel to visualize the RNA. Eighteen and a half percent of ticks tested were carriers of the virus. The virus was heterogeneously distributed with certain sites having virus carrier rates as high as 56% and others as low as zero percent. The total percentage of ticks containing the virus is within the ranges of past studies, however, it is not known what additional factors might account for the uneven distribution observed. Additional data should be collected in the future to determination of factors influencing the virus’ distribution. A risk assessment map can be created to decrease the risk of humans being bitten by a virus carrying tick, and better diagnose those who may be infected.

Chloe Hendrickson, English Literature

The Daughter and Wife in Patriarchy: An Analysis of Spatial Politics in *Wide Sargasso Sea* and “The Colossus”

The purpose of this paper is to analyze the aesthetics and politics of gendered spaces in Jean Rhys’ novel *Wide Sargasso Sea* (1966) and Sylvia Plath’s poem “The Colossus” (1960). Both Rhys and Plath use aesthetic strategies—such as metaphors, imagery, and language—to highlight the confinement of the female protagonist/speaker in male-dominated spaces. This paper will explore these aesthetic strategies by first situating the authors’ projects within their specific historical and social contexts. Dominica-born British author Rhys writes from a colonial feminist perspective whereas Plath writes from a 1950s’ US feminist perspective. Both authors develop spatial imagery to represent and challenge the trope of the subdued wife or daughter in patriarchal spaces. This paper then explores the feminist overtones of these spatial images. The female speaker in “The Colossus” admits that she longs to participate in the spheres of society that are occupied by men, and her only hope of participating in those spheres is to submit to these authoritative male figures. The female protagonist in *Wide Sargasso Sea* becomes increasingly “mad”—this madness is nothing short of determined resistance to the limitations that patriarchal codes and conventions have imposed on her. Although neither text closes with female empowerment, both critique and reject the systems of patriarchal oppression within which the authors themselves are historically located. Both authors suggest that the confines of patriarchy are not fixed; Plath’s cynical tone in her poem challenges the reader to reject patriarchy, and the closure of Rhys’ novel suggests that there is hope for change in favor of women.
Carly Schwickert, Psychology

The Effects of Objectifying Statements on Women’s Self-Esteem, Happiness and Body Image

Research has shown that women have lowered self-confidence ratings after being harassed by a stranger (e.g. Fairfield & Rudman, 2008) and perform worse on mathematical tasks after receiving an objectifying gaze (e.g. Gervais, Vescio, & Allen, 2011). We were interested in the effects of objectifying statements from attractive and unattractive strangers on women’s self esteem, body image and happiness. Participants included 101 female students. Individuals assumed they were participating in an Accuracy of First Impressions study and completed an online personal questionnaire, which they believed a peer would read to create a first impression of them. Participants then met in person with the researcher to examine their first impression statement, which was paired with a photo of either an attractive or unattractive male. They then completed a reaction to the first impression questionnaire and inventories examining their body image (Body Image Scale), self-esteem (Current Thoughts Scale), and happiness (Subjective Happiness Scale). In reality, individual’s information was not shown to anyone and they were randomly assigned to view statements regarding attractiveness, personality or objectification, which were written by the researcher. Results showed that participants who received objectifying statements had more negative feelings towards the male and a thinner body image than those who received statements about their personality or attractiveness. Contrary to predictions, women receiving objectifying statements reported more positive emotions than those who received personality or attractive based statements. Opposing the hypothesis, self-esteem was not altered by statement type. The attractiveness of the male did not have an effect on happiness, self-esteem or body image. This study highlights the positive and negative effects of word choice in everyday encounters involving women and men.

Anthony Wood, History

What Reagan Knew: A Re-evaluation of the President’s Role During the Iran-Contra Affair

As the Iran-Contra scandal broke in late 1986, the public questioned how deep the corruption, illegality, and cover up permeated the office of the Executive. The investigations determined that high ranking government officials at the National Security Council and the CIA conducted operations in the face of congressional laws to support the Contra Rebels of Nicaragua. This was done by using the residual funds from arm sales to the Iranians in exchange for the release of several hostages taken by terrorists in Lebanon, nearly every aspect of which is in direct opposition to U.S. foreign policy. This paper is a re-evaluation of President Reagan’s role in the different operations, primarily focusing on the “diversion” of funds to the Contras. While the sheer amount of documents destroyed by NSC officers Oliver North and his superior John Poindexter left the investigation no choice but to consider the President ignorant of the illegal proceedings, the mounting circumstantial evidence should lead us to reconsider Reagan’s role to be far more active and aware than was believed in 1987.

Hugh Pratt, Sociology

The Nez Perce Environmental Economy

The Nez Perce Indians face a difficult task ensuring their cultural and religious ties to the environment in a world constantly in search of natural resources. The problems faced by the Nez Perce are not uncommon and occur on many Montana tribal lands as well. This thesis focuses on providing a complete picture of the Nez Perce Nation and its relationship to its environment with regards to the cultural, religious, and financial viability of the tribe. Incorporating many different secondary sources and the use of two sociological theories, phenomenology and rationalization, this thesis helps answer the question of how
the Nez Perce do it. On an individual level, the tribal members may display or harbor different ideas about their environment compared to that of the tribe. However, the tribe maintains a strong sense of cultural and religious attitudes towards their environment while also seeking financial benefits from its natural resources. While the case of each tribe is different, the Nez Perce provide an example of maintaining traditional beliefs in regards to natural resource consumption.

Steve Edmonds, Biology

Using Glycosylated Hemoglobin and Heat Shock Protein 70 as Biomarkers for Thermal Stress in North American Pikas (Ochotona princeps)

North American pikas (Ochotona princeps), high altitude relatives of rabbits, are one of the first mammals to be directly affected by global warming. Population decline has been observed in pika populations in both Nevada and California. The cause of their decline is unknown, but several studies suggest that heat stress at lower altitudes is a contributing factor. In Montana, populations are potentially being stressed in the same way. This study looks at heat shock protein 70 (HSP70) and glycosylated hemoglobin levels in high and low altitude pika populations as biomarkers for thermal stress. Pikas were trapped from Gold Creek (1962m) and Vista Point (2832m) Montana, and blood was extracted and separated into plasma and packed blood cells. ELISA high sensitivity test (Enzo® catalog# ADI-EKS-715) were used for HSP70 quantification. Chromatography and spectrophotometric techniques, using m-animophenylboronic beaded gels, were used to calculate the percentage of glycosylated hemoglobin. A strong positive correlation was seen between HSP70 levels and weekly average ambient temperatures prior to capture. Due to the inconsistent nature of the glycosylated hemoglobin results, these assays were unable to support the claim that oxidative stress is a factor caused by direct thermal stress. Future work will include attaining a larger sample size, locating more trapping sites, and obtaining further temperature data. These results will be strengthened by refining techniques to assay for glycosylated hemoglobin before conclusions can be made.
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