

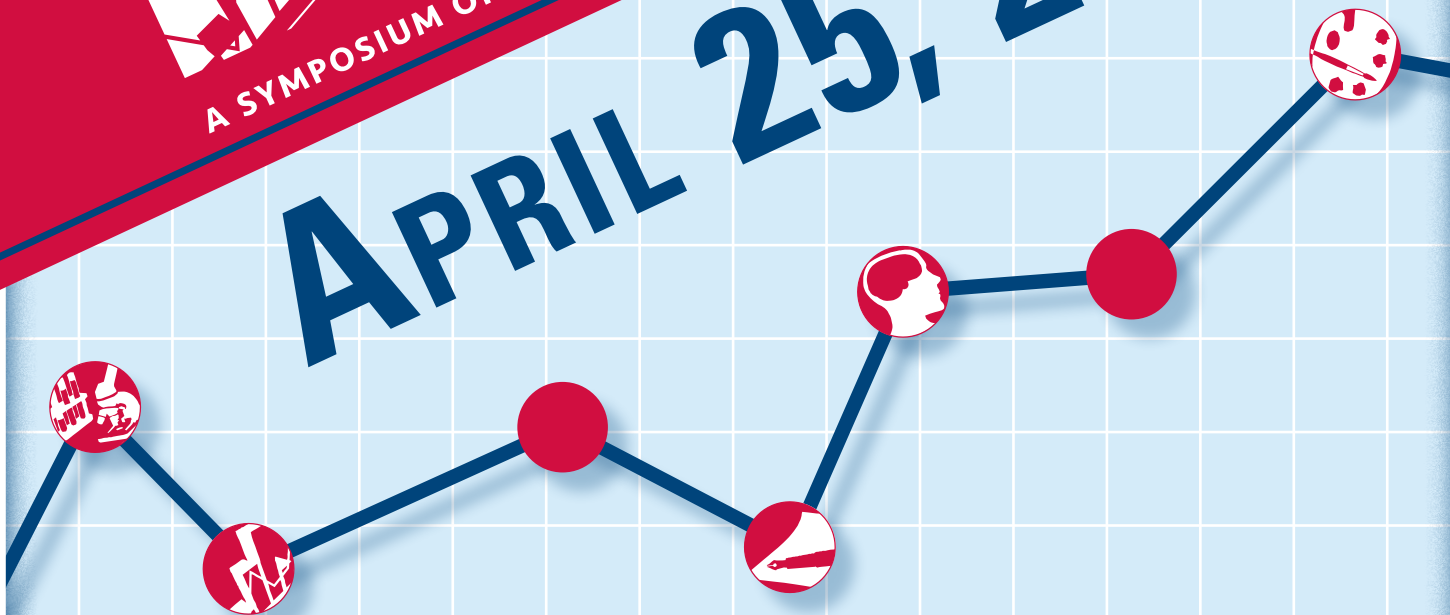


**3RD ANNUAL
UNDERGRADUATE RESEARCH CONFERENCE**



A SYMPOSIUM OF SCHOLARLY WORKS AND CREATIVE PROJECTS

APRIL 25, 2014



Sponsored by

Metropolitan State University of Denver
Undergraduate Research Program

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Undergraduate Research Program Mission

The URP at MSU Denver seeks to engage students and faculty in meaningful and rewarding research experiences and projects thereby promoting active, engaged, experience-based learning. Students participating in undergraduate research gain a deeper understanding of their field and are more prepared for jobs requiring creativity and exploration as well as graduate and professional schools.

The URP promotes, supports, and celebrates faculty and student engagement in undergraduate research activities. The URP defines undergraduate research as: Scholarly and creative endeavors accepted within one's discipline as activities contributing to the body of knowledge in one's field. Undergraduate research seeks to examine, create, and share new knowledge or works in ways commensurate with practices in a particular discipline. Undergraduate research projects involve student-faculty collaboration in the form of either student initiated projects overseen by a faculty mentor or faculty initiated projects involving students as integral members of a research team. Undergraduate research projects include a dissemination component wherein the results and outcome of the work are shared with a broader scholarly/creative community in some form. This definition includes the four tenants of undergraduate research: mentorship, originality, acceptability, and dissemination.

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At Metropolitan State University of Denver, we are *Transforming Lives, Communities, and Higher Education*. We provide opportunities in the classroom, in a laboratory setting, and in our surrounding communities to pursue knowledge so that we may contribute to our fields of study and those around us as well.

At MSU Denver's 3rd Annual Undergraduate Research Conference: A Symposium of Scholarly Works and Creative Projects, this transformation is showcased on numerous levels. By engaging in undergraduate research, you are developing essential skills relevant toward the pursuit of a particular trade, graduate school program, or the betterment of our communities. Because so many MSU Denver graduates remain in the Denver Metro area, we are instrumental in the transformation of communities; this year that contribution was apparent as some of the research projects conducted were catalyzed by The Colorado Charge, an Undergraduate Research Program initiative in which the Governor's Office of Community Partnerships encouraged students to give back to their community by evaluating social issues, specifically homelessness.

My thanks to Dr. Sheryl Zajdowicz, Faculty Director of Conference Planning, Dr. Virginia McCarver, lead faculty associate for the Undergraduate Research Program, a division of the Applied Learning Center, and all of the dedicated faculty and staff who helped make this year's conference the great success to which we have been accustomed.

Congratulations to each student presenting a research project, to each faculty member who mentored students on those projects, and to everyone in attendance for engaging in discussions about the amazing projects conducted at MSU Denver!

Stephen M. Jordan, Ph.D.
President

It is my pleasure to welcome you to the third annual Undergraduate Research Conference at MSU Denver! The conference showcases the intellectual curiosity, drive, and dedication of our students and faculty. The wide array of presentation topics you'll find in the pages of this program speaks to the diversity and breadth of expertise on campus. We are a campus devoted to engaging our students in the passion of lifelong learning and the pursuit of knowledge; we are invested in making contributions to ongoing conversations in our fields of study and within our communities.

This year, MSU Denver's Undergraduate Research Program, a division of the Applied Learning Center, found inspiration in the close connection between the greater Denver community and our campus. Roughly three-fourths of our graduates remain in Denver after graduation: they work, live, and raise families in our community.



Participation in undergraduate research is not only a means to help ensure students are well equipped for post-baccalaureate programs, or highly skilled careers, it fosters the skills and abilities to grow strong communities. Critical thinking, sophisticated analysis, the desire to make a contribution and participate in the conversations that surround us and influence our lives—these are the characteristics we want in our neighbors and community members, and these are the skills students participating in undergraduate research are developing through their work and growing expertise.

Thank you to all who have participated in undergraduate research this year, and my congratulations to those of you whose names appear in this program.

Sincerely,

Dr. Vicki L. Golich
Provost and Vice President for Academic & Student Affairs

Keynote Presentation



Jake Norton, MountainWorld Productions

“Getting FITT: Climb Your Everest, and Enjoy the Journey”

Jake Norton is a world-renowned climber, photographer, filmmaker, and speaker. In his acclaimed keynote "Getting FITT: Climb Your Everest, and Enjoy the Journey", Jake takes audiences out of their seats and onto the slopes of Everest with him. With vivid storytelling and stunning images from his seven Everest expeditions, Jake shares stories of research and discovery, triumph and tragedy and perspective on the world's highest peak. From the historic discovery of pioneer climber George Mallory's remains in 1999 to breathtaking rescues high on the mountain in 2003 to reaching the 29,035 foot summit in 2002 (and again in 2003 and 2009), Jake's Everest stories inspire and help teach audiences the keys to success on all of life's mountains: Vision, Fear, Instinct, Teamwork, Tenacity, and The Summit Perspective.

Conference-at-a-Glance

8:00am-3:00pm:	Conference Participant Sign-in Student Success Building (SSB)- Atrium <i>Light refreshments will be provided in the morning</i>
8:45-10:15am:	Conference Session I Oral Presentations- SSB Room 200: Humanities/Social Sciences Room 203: Humanities/Social Sciences Room 204: Natural Sciences Room 205: Mountain Environments and Avalanche Research Room 206: Technology and Industrial Design Room 209: Business and Resource Needs Poster Presentations (9:30-10:30am) – SSB Mezzanine
10:30-12:00 pm:	Conference Session II Oral Presentations- SSB Room 200: Humanities/Social Sciences Room 203: Mathematics and Physics Room 204: Natural Sciences Room 205: Technology Room 206: Colorado Charge Poster Presentations (11:00-12:00pm) – SSB Mezzanine
12:15 pm	Lunch Turnhalle, Tivoli Student Union
12:30-1:30 pm	Keynote Speaker: Jake Norton, MountainWorld Productions <i>“Getting FITT: Climb your Everest...and Enjoy the Journey!”</i>
1:45-2:45pm:	Break-out/Information Sessions- SSB Room 205: Career Services Room 206: Graduate School/Funding Graduate School Room 209: Jake Norton: How to Overcome Your Everest
3:00-4:30pm:	Conference Session III Oral Presentations- SSB Room 200: Humanities/Social Sciences Room 203: At Home in the Mile High City: A Panel of Student Digital Ethnographies Room 204: Natural Sciences Room 205: Technology Poster Presentations (3:15-4:15pm) – SSB Mezzanine

Acknowledgements

We would like to extend our thanks and appreciation to the following offices and individuals for their contribution to the success of the conference.

Applied Learning Center Staff
Auraria Library (especially Lorrie Evans)
MSU Denver Alumni Relations
All Volunteers
Amanda Berry

Session Moderators
MSU Denver Career Services
Keynote Speaker: Jake Norton
Eriks Humeyumptewa
The Writing Center

A very special thank you to Karina Hultgren for the amazing work that she completed to ensure that this conference is a success. Special thanks to Lisa Padgett for designing the poster for this year's conference, and to Peter Bergman for all of his assistance in editing all communication designs.

Undergraduate Research Conference Planning Committee

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Dr. Maria Akrabova (Spanish)
Dr. Kristen Lyons (Psychology)
Dr. Jeffrey Helton (Health Professions))
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Scheduling/Conference Program

Dr. Sheryl Zajdowicz (Biology)

Presentation Abstracts

(listed alphabetically by primary student's last name)

Design of Algorithms for the Automated Generation of DNA Bio-Sensors

Rebecca Addison - Chemistry

Coauthor: Jody Stephens

Faculty Mentor: Andrew Bonham

Human transcription factors are proteins that play an important role in both normal development and in many disease responses. Recent bio-engineering advances have led to a specific design of a structure switching fluorescent bio-sensor which can detect a specific transcription factor. This bio-sensor utilizes a sequence of DNA that can fold into two different structures in near equilibrium. However, there are thousands of human transcription factors, and we have thus generalized this design and implemented a software platform, Fealden, which generates sensors for any transcription factor. In this platform, we use a depth first search to find a possible sequence. We determine the validity of this sequence by leveraging existing energy minimization software tools to predict all possible conformations of the sequence, then analyzing that output for metrics including point to point distances and stem presentation. Upon completion of this process, a successful bio-sensor design is returned with calculated equilibrium constants and free energy values. Current work is focused on generalizing this platform to work with more complex bio-sensor designs, such as enabling expansion into electrochemical sensors. These improvements have included the use of the principles of graph theory to perform a detailed calculation of distance between arbitrary points in a 3D DNA folding, as well as generalizing how we prune our search tree. Ultimately, this algorithm design will provide a general, expandable representation of these transcription factor sensor designs, providing the ability for academics and medical technicians to more accurately and readily measure transcription factor levels to diagnose and understand cellular processes.

(Oral Presentation, Session I, Room 204, 8:45 AM)

High-Level Financial Dashboard

David Aggar – Computer Information Systems (CIS)

Coauthors: Erika Tappe, Eugene Bonsu, Daniel Acuna, Aaron Powell

Faculty Mentor: Biswadip Ghosh

The question of an organization's financial health is always an issue for top executives within the company and investors with respect to financial stability, growth, or decline. The submitted dashboard, created using SAP Crystal Dashboard Design 2011/2013, will allow a high-level overview of these issues, graphically displaying the most pertinent financial information. This financial dashboard is meant to be a "one-stop-shop" for financial health information that will be organized and grouped into five tabs: Income Statement, Balance Sheet, Cash Flows, Financial Ratios, and Stocks. Particularly valuable for executives is an embedded, live stock ticker found in the Stocks tab that updates in real-time. Another key feature is the ability to organize historical financial data into important metrics. Built with publicly available data from Exxon Mobile(NYSE:XOM), this dashboard can be altered to accommodate any company's data. Created in response to a business intelligence group project required for Metropolitan State University of Denver's Computer Information Systems class, CIS 3050 Fundamentals of Systems Analysis and Design, the methodologies used in designing the dashboard are Rapid Application Development (RAD) and prototyping.

(Oral Presentation, Session I, Room 209, 9:00 AM)

Small Scale Three Stage Cascade Refrigeration System to Liquefy Natural Gas

Richard Anderson- Mechanical Engineering Technology (MET)

Coauthors: Seth Walsh and Travis Mathis

Faculty Mentor: Lynne Zhao-Bowden

Three-stage cascade refrigeration system is used to lower the temperature of various liquids in a controlled environment to achieve liquefaction of various gasses, like natural gas, that vaporize at standard atmospheric pressure. In today's industries, liquefaction of gasses using high tech equipment can cost thousands of dollars. However, with the proper understanding of basic refrigeration cycles, off the shelf components can be used to help privatizes the production of various liquids like liquid natural gas (LNG). In this research, a small scale three stage refrigeration system is designed to reduce natural gas at room temperature to a desired temperature of about -100°C to -150°C so that it can be liquefied and deposited to a storage container for later use. To guarantee the desired temperature to liquefy the gas in the most efficient way, a condenser is used as a heat exchanger at the first stage to blow ambient air over the coils. In the second and third stages, integrated heat exchangers are incorporated into the system to transmit heat through the cascade system. Different types of refrigerants were also analyzed in this research to obtain the most efficient and effective way to reach the desired temperatures. Based on the analysis, under the same operating pressure of 5-20 psig suction pressure at all stages, MO-99 refrigerant is used at the first stage for an operating temperature of -15°C to -20°C. R-410 is selected at the second stage for an operating temperature of -30°C to -60°C. The third stage will use a reduction in pressure of an air chamber, utilizing the ideal gas law relationship to liquefy air. This liquefied air will then be used to create LNG.

(Oral Presentation, Session I, Room 206, 8:45 AM)

Stereochemical Selective Hydrolysis of Racemic Esters with Lipase

Mila Antonik - Chemistry

Coauthor: William Barela

Faculty Mentors: Sue Schelble, AnnaMarie Drotar

The research investigates the synthesis of chiral esters from a racemic mixture of enantiomeric substitutedaryl ethanol of the form 1. Alcohols were selected based on substituents in the form (X) to the benzene ring that are either electron donating or electron withdrawing. The research summarizes the methods for formation of several racemic esters of type 2 and the effectiveness of chiral resolution of these compounds with Novozyme lipase as compared to investigations using *Aspergillus oryzae*. The hydrolysis with lipase leads to only one enantiomer of the original alcohol of the form 4, leaving the unhydrolyzed ester as a single enantiomer of the form 3. The research reported the mechanisms of the esterification process, selective hydrolysis, and a comparison of outcomes with a variety of substituted aryl pieces when one ester and one alcohol were resolved from a racemic mixture. The study is based on work by Ulf Hanefeld using Novozyme lipase. In addition, analytical methods for ascertaining structures and effective hydrolytic resolution are described.

(Poster Presentation, Session I (9:30-10:30 AM), Poster #1)

The Implications of Tomorrow: How the Minimum Wage Affects our Lives

Jackeline Arce-Castro - Management

Faculty Mentor: Cynthia Sutton, William Carnes

In his book, *Wealth of Nations*, Adam Smith suggests that “Consumption is the sole end and purpose of all production.” For many Americans consumption comes in the form of shelter, food, clothing, entertainment, education, and the overall quality of life they gain from earning a decent wage. Consumption, however, comes at a price. For businesses it is the costs they pay employees for their labor. For employees, it is the wages they earn from their work. And for the economy as a whole, it is the amount spent each year on goods and services. When wage floors are imposed on society both positive and negative implications may occur. Those in favor of the minimum wage hike shed light on the hundreds of thousands of families who will be lifted out of poverty. Those opposed to the increase argue that higher costs to businesses will cause significant job reductions across the nation, putting hundreds of thousands of minimum wage earners out of work and out of luck. It is imperative to understand that those most affected by the increase will be the poor. This will include elderly workers supplementing their existing income; teenagers, many of which will be working their first jobs; and under skilled workers that depend on minimum wage jobs to survive. Although the increase will help these families it will also cause businesses to pass on those costs to consumers in the form of higher prices for goods and services. This will affect the entire economy which is why it is important to understand the implications Americans face in light of this new law.

(Oral Presentation, Session I, Room 209, 8:45 AM)

Dietary Overlap in Eurasian Collared-doves (*Streptopelia decaocto*) and Mourning Doves (*Zenaida macroura*) in Weld County, Colorado

Cole Archer – Environmental Science

Coauthor: Letitia Salazar-Monk

Faculty Mentor: Christy Carello, Christopher Meloche

The Eurasian Collared-dove (*Streptopelia decaocto*) is an invasive species and may be contributing to declines in native species, such as Mourning Doves (*Zenaida macroura*), due to resource competition. Studies of captive collared and mourning doves indicate a high degree of dietary overlap, but few studies have examined their food preferences in the wild. Our initial objective was to compare the dietary composition in a sympatric population of collared and mourning doves in Weld County. A local hunter was commissioned to provide us with 10 specimens of each species during the hunting season (27 Sept 2013). To our surprise we obtained 19 collared doves and only one mourning dove. This mistake was made because many of the collared doves were juveniles and because there were very few Mourning Doves in the population. We compared the birds’ crop contents to the vegetation found at the collection site. When diets were compared, both the collared dove and the Mourning Dove consumed *Zea mays* (the primary cultivar in Weld County), and native plant species were consumed differentially by the two species. Preliminary data has provided us with a strong feeding profile of the Eurasian Collard-doves of

Weld County. Work continues on the feeding profile of the Mourning Dove to complete the comparison of dietary preferences.

(Poster Presentation, Session II (11:00-12:00PM, Poster #1))

Terror Management Theory: Connections to Prejudice and Other Creative Applications

Travis Atwood – Psychology

Faculty Mentor: Anna Ropp

Terror management theory is an area of social psychology that applies to many areas of any individual's daily life, albeit not always consciously. Terror management theory (TMT) is based largely on the idea that because humans are conscious creatures, we are able to project ourselves forward in time and confront the reality of our eventual death. This confrontation of death leads to fear and anxiety which we must cope with in some way. Awareness of death is called mortality salience (MS) and manipulating MS to see how it affects our worldview and self-esteem is the technique most researchers use to empirically test TMT. I will look at how TMT and MS manipulations affect stereotypes and prejudices and also a variety of applications that may occur in the course of daily life. In addition, terror management theory opens up some other creative research avenues. Studies that have more popular appeal and accessibility may serve to generate interest in this field of research going forward. This being so, a few studies that investigate terror management theory in creative ways will also be discussed. These studies show the effects of mortality salience in the tangible, real-world areas such as politics, advertising, and romance.

(Oral Presentation, Session II, Room 200, 11:00 AM)

Geochemistry and Petrology of the Dora Bay Pluton: A Potential Equivalent to the Bokan Mountain Pluton, Rare Earth Element Resource

Sara Bala – Environmental Science

Faculty Mentors: Uwe Kackstaetter, Chris Holm-Denoma (research geologist, US Geological Survey, Department of the Interior)

The Dora Bay pluton is a peralkaline intrusion that is likely age equivalent and within 15 miles to the Bokan Mountain pluton, which is one of three advanced Rare Earth Element (REE) resource projects in the U.S. This region is a diverse assemblage of igneous, metamorphic and sedimentary rocks known as the Alexander Terrane and ranges in age from Late Proterozoic to mid-Cretaceous. This area is noted for its uranium-thorium deposits and its substantial rare metal deposits associated with rare earth elements U, Y, Zr, Nb and Ti. Rare earth elements (REE's) are used in high-tech and energy efficient applications and are of great economic importance. Currently, the USGS Minerals Resources Program is evaluating the potential REE mineral resources at Dora Bay, because of its geological similarities to the Bokan Mountain pluton. Deposits with significant REE concentrations have been found at Bokan Mountain and further evaluations done by the U.S Geological Survey have reported unusually high concentrations of Heavy Rare Earth Elements and the rare mineral eudialyte which is of great economic importance because of its mineralogical structure. Geochemical and petrological analysis from Dora Bay samples will be used and compared to data from Bokan Mountain. Petrological analysis will give an indication of the bulk rock mineralogy as well as present trace mineral composition. REE concentrations from Bokan Mountain and Dora Bay will be compared in order to determine the potential mineral and REE reserves.

(Poster Presentation, Session I (9:30 - 10:30 AM), Poster #3)

Self-Compassion Meditation and Resilience

Heidi Baldwin-Kirchhoff – Psychology

Faculty Mentor: Pamela Ansborg

Resilience is a personality trait that enables individuals to overcome daily stressors and life challenges. Resilience is an important factor in well-being and stress reduction. Research indicates that the trait of resilience may be developed and increased. Mindfulness meditation has shown promise in increasing individual resilience levels. Mindfulness meditation is of Buddhist origin and is the ability to be aware of one's thoughts and not judge the thoughts as they pass through the mind. Individuals who show higher levels of self-compassion as a trait also tend to have higher resilience levels. Self-compassion is the ability to treat oneself with kindness when presented with shortcomings. The present pilot study tested the hypothesis that self-compassion meditation would result in higher resilience levels when compared to mindfulness meditation. What makes the self-compassion meditation technique distinct from mindfulness meditation is the focus on personal inadequacies and expressing kind emotion towards oneself. Participants were 11 females and 8 males ($M=20.10$, $SD=2.26$), who were randomly assigned to a relaxation meditation or self-compassion meditation and a resiliency scale. There was not a significant difference in resilience between the self-compassion meditation condition and the relaxation meditation condition ($t(17) = -0.88$, $p = .39$). However because the participants in neither condition reported a strong feeling of meditation effect ($t(17) = 1.66$, $p = .12$), the meditation manipulation failed to work; thus, the study did not allow for an adequate test of the hypothesis. The failure of the meditation manipulation may have been caused by the classroom setting in which the sessions were run, the short duration of the meditation, and/or the participants' lack of prior meditation experience. Future research needs to ensure conditions that lead to mediation effects before we can detect if self-compassion meditation is useful in developing increased resilience.

(Oral Presentation, Session III, Room 200, 3:00 PM)

Campus and Community Alley Integration Project: A Multi-Use Proposal

Rebecca Ball – Behavioral Science

Faculty Mentor: Linda Marangia

Students of the class "The Neighborhood and Social Dynamics" conducted a service learning research and development project for Auraria Higher Education Center (AHEC) administrators and planners. The focus of the project revolves around the alley between St. Elizabeth Church of Hungary and Central Classroom, an alley which has been left out of the AHEC campus revitalization Strategic Implementation Plan (SIP) as a zone of disregard. Class researchers used the methodologies of searching documents, asking questions, making observations, and immersion, to develop community dialogue around the integration of the alley into the AHEC SIP, with an identity and multi-use function. The alley and surrounding areas serve a variety of populations and the project sought to meet the needs of the various affected stakeholders, including Auraria students, faculty, and staff, parishioners and patrons of St. Elizabeth, and the Community College of Denver St. Francis Center. Though many stakeholders were identified, the project concentrated on maximizing improvements to affect the homeless population, students, and faculty. Project researchers found the alley lacks a unique identity as a place and offers minimal benefits for students, underutilizes opportunities as a pedestrian path, needs a variety of aesthetic, safety, and comfort improvements, and the dilapidated pavement can create hazardous conditions. Recommendations range from short- and long-term, with a focus on safety, attractiveness and aesthetics, incorporating student services, instituting an identity and function for the alley, and

establishing an open dialogue between the alley neighbors. The project proposals present an opportunity for student engagement in transforming the blighted alley into a functional, multi-purpose neighborhood with its own distinctive identity.

(Oral Presentation, Session I, Room 203, 9:45 AM)

Investigating Predicted, Novel ATF3 and MAX Protein-Protein Interactions Using DNA Bio-Sensors

Elina Baravik – Biology

Faculty Mentor: Andrew J. Bonham

The Encyclopedia of DNA Elements (ENCODE), a National Human Genome Institute project, is a collaborative effort to identify areas of transcription, transcription factor binding, chromatin structure and modification in the human genome. One recent ENCODE study investigating protein-protein interactions across the genome discovered a large number of novel interactions that have not been observed in prior work. As a continuation and validation of this effort, we are characterizing the novel binding interaction identified between ATF3 and MAX, two transcription factor proteins deeply involved in cell regulation and function. These proteins bind to DNA, and we are probing the impact of their interactions with each other on their DNA binding affinity and specificity. To do so, we are using DNA-based bio-sensors that fluorescence proportionately to the extent of DNA-binding activity. We designed these bio-sensors from first principles, as well as expressed and purified the protein products. Upon examination of the binding of the proteins at varied concentrations to the bio-sensors we have discovered a synergistic relationship between ATF3 and MAX binding affinity to one another's bio-sensor. While ATF3 protein does not display strong binding affinity to the MAX bio-sensor, the addition of an initial concentration of MAX protein significantly improves binding of ATF3. The same relationship was observed when probing the binding of MAX protein against the ATF3 bio-sensor. Ultimately, a comprehensive understanding of these interactions will enrich the depth of the ENCODE project and provide a greater understanding of novel cellular pathways involved in cell growth and development.

(Oral Presentation, Session II, Room 204, 10:30 AM)

Case Study: Sheep Creek Avalanche 4/20/2013. Meteorological Forcing Mechanisms and Deep Persistent Slab Formation in a Seasonal Snowpack

Nick Barlow - Meteorology

Faculty Mentor: Richard Wagner

This focused study of the 5-fatality Sheep Creek Avalanche event presents the scenario of deep persistent slab (DPS) formation within the snowpack formed early in the water-year, eventually contributing to a large human-triggered avalanche late in the season. For this incident, the primary factors found contributing to DPS formation and snow-crystal metamorphosis were due to meteorological forcing mechanisms existing along the Front Range of Colorado during the winter of 2012/13. Specifically, cold daily average temperatures in combination with shallow snow depth resulted in high perceived temperature gradient within the snowpack, and significant periods of faceting and weak-layer formation. Data from alpine weather stations, such as SNOTEL, were analyzed versus on-site snow profiles from near-by locations. Additionally, a manual temperature gradient data model was employed to compare annual cycles near the incident location. Meteorological data was also taken from the period directly preceding the incident in order to analyze stability and possible snow-load/triggering mechanisms on the day of the avalanche. By comparing data from previous winters, 2012/13 was found to be a particularly dangerous season in terms of snow stability and structure pertaining to DPS slab avalanches. Although seemingly verified through the methods and analysis in the study, it is rare that all of these factors line-up

and eventually culminate in such a profound single incident. Therefore, this study should be viewed as experimental in nature, yet, still useful in studying the structure and stability of a winter snowpack.

(Oral Presentation, Session I, Room 205, 8:45 AM)

Digesting Food for Thought: A Nutrient Analysis of Food Given to Low-Income Families to Determine Dietary Sufficiency Against the National Standards

Justin Batchelder – Nutrition

Coauthor: Adrienne Bacon

Faculty Mentor: Bruce Rengers

This project was designed to analyze the nutritional adequacy of meals provided by Food for Thoughts' (FFT) PowerSacks. Elementary school children (ages 3-12) in Title 1 schools rely on school breakfast and lunch programs for food during the week, which makes getting enough food on the weekends a challenge. PowerSacks supply enough food to feed a family of four over the weekend, and consist of two meals plus snacks that require little to no preparation. This program, which serves over 900 children during the school year, provides adequate nutritional quantity; however, the nutritional quality had yet to be formally assessed. Food is purchased from the Food Bank of the Rockies (at a cost of \$4 per PowerSack), and choices are limited based on availability, shelf life, and quantity. The PowerSacks consists of non-perishable items, which may put limits on the nutritional diversity and quality. We recorded the total amounts of food in each PowerSack for 5 weeks to obtain an average report of what was allotted. My Diet Analysis program was used to interpret the nutrient profile. We focused on evaluating total calories, carbohydrate, protein, fat, vitamin C, vitamin A, iron, calcium, sodium and sugar content. We constructed a family model consisting of a mother, father, (ages 19-50) and two children (ages 6 and 11). Then we referenced the United States Department of Agriculture (USDA) Recommended Dietary Allowances (RDAs) to garner the appropriate nutrient requirements for each individual. The nutrient density and quality of these food items were also assessed. The results of this study will be presented to FFT's board. This will provide them with a detailed nutrient profile for their consideration of future PowerSacks.

(Poster Presentation, Session I (9:30 - 10:30 AM), Poster #9)

Designing for a Professional Client

Derek Berthold – Industrial Design

Coauthor: Megan Hull

Faculty Mentor: Michael Caston

In our Intermediate Studio class, we are commissioned by a professional client who provides us with a design brief stating various goals and objectives to follow in order to create a successful design. In this case, the client was Brian Gross of SmartCo International, and the objective was to create the industry standard for a cold brew coffee system. After our initial meeting, we were given the needs that the client desired. We then furthered our testing by researching the client's key competitors. After establishing the shortcomings of the competing products, and having conducted our extensive research online, through interviewing, etc., we began ideating various concepts. In this process, our goal is to put as many ideas down as possible. Nothing is met with immediate criticism as a volume of concepts are the key goal. We then weeded out concepts that were not feasible or failed to meet the design criteria. Once we settled on a couple key concepts, we refined those sketches and developed those concepts. From there we took the concept we thought had the most promise and created a 3D model. This model underwent a series of

developmental changes as, we were constantly looking to refine the design as well as audit or adherence to the design criteria. The final outcome was a design that addressed not only the needs of the client, but addressed the problems that we experienced firsthand through testing while also recognizing the opinions of online reviewers and coffee shop employees alike. This was a tremendous opportunity, as it gave us the chance to work in a professional setting.

(Oral Presentation, Session I, Room 206, 9:30 AM)

Storm Water Mitigation Best Management Practices: A Study On The Design and Function

Tami Bishop – Environmental Science

Faculty Mentor: Jason Janke

Storm water detention basins are one of several means of stormwater runoff mitigation to prevent urban flooding. Many styles are used depending on location, watershed size, ratio of impervious and pervious area, land use, receiving water standards, and other factors. Basins are designed according to "Best Management Practices" or BMPs to serve important purposes such as cleaning, purifying, and reducing storm surges from runoff as well as preventing storm sewer collection systems from being overwhelmed. Each technique saves wastewater facilities money in extra treatment and storage and prevents costly repairs to collection systems. The purpose of this study is to determine the efficiency of storm water detentions basins to retain pollutants such as metals and nutrients. This study has two phases: Phase I was conducted from April, 2013 through December, 2013 and focused on the efficiency of pollutant removal from a constructed wetland BMP in Barnum Park, Denver, Colorado, while Phase II is focused on developing Operations and Maintenance Plans for five BMPs and is being conducted from January, 2014 through May, 2014. Results from Phase I of the study indicated that the contaminant levels were higher in the outlet than at the inlet. BMP The purpose of Phase II is to establish a lifetime cost analysis of five different styles of runoff detention BMPs within Denver including Berkeley Lake, Sloan's Lake, Barnum Park, Overland Park, and a BMP on the property of the City and County of Denver Public Works Maintenance Facility. The combination of both phases will result in considerations for future BMP styles and sizes to be used based on efficiency of pollutant removal versus expense of initial construction and ongoing maintenance. Both studies will also determine whether the five existing BMPs are meeting expectations or will need modifications to reduced water contention and maximize the efficiency of the storm water detention basins.

(Poster Presentation, Session II (11:00 - 12:00 PM), Poster #2)

Simian Varicella Virus is Present in Lymph Nodes of Rhesus Macaques after Experimental Reactivation

Anna Blackmon – Biology

Faculty Mentor: Sheryl Zajdowicz

Clinical, pathological, immunological and virological features of simian varicella virus (SVV) infection of primates parallel human varicella zoster virus (VZV) infection. Primary SVV infection of primates causes, varicella, after which virus becomes latent in ganglionic neurons and reactivates upon social and environmental stress. Earlier, we demonstrated experimental reactivation of SVV after X-irradiation and treatment with tacrolimus and prednisone of latently infected monkeys. Herein, 5 rhesus macaques were inoculated intrabronchially with 104 pfu of SVV or SVV-EGFP (SVV expressing green fluorescent protein) and 5 months later (latency), 4 monkeys were transported to an irradiation facility and exposed to a single dose (200 cGy) of X irradiation and treated with tacrolimus (80µg/kg/day) and prednisone (1mg/kg/day) for the duration of the experiment; one monkey was not immunosuppressed, but was

subjected to the stress of transportation. Zoster rash developed 7-12 weeks after immunosuppression in all 5 monkeys which were euthanized 24 -48 hrs later, and multiple tissues (skin, lungs, ganglia and lymph nodes) were harvested. In all 5 monkeys, immunohistochemistry revealed SVV antigens in these tissues and immunofluorescence analysis of multiple lymph nodes corresponding to the area of rash showed colocalization of SVV immediate early protein 63 (IE63) in macrophages and dendritic cells, but not in lymph nodes from SVV-seronegative monkeys. Detection of SVV IE63 was confirmed by Western blot in 2 of 2 lymph nodes from one monkey and by qPCR detection of SVV DNA in 3 of 3 lymph nodes from another monkey. Macrophages and dendritic cells in lymph nodes may serve as antigen presenting cells to activate T cell responses against SVV.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #5)

Experiencing Homelessness with a Medical/Physical Condition in Denver, Colorado

Ian J. Bonesteel - Anthropology

Faculty Mentor: Rebecca Forgash

The intent of the study is to understand the experience of homelessness and its effects on disabling physical and/or medical conditions, and how in turn these affect the experience of homelessness. It is an attempt at telling the stories of the people living on the streets, with the joys, trials, and tribulations, as well as gathering data that can be useful to medical providers and policy makers using ethnographic techniques. Medical and physical conditions are both included because their treatment both lie in the medical system that they are largely excluded from. While mental illness may be co-occurring, it is not the focus of the study. Ethnographic research is often undertaken with an inductive approach. That being the case, certain themes that will be investigated during the research will be how people experiencing homelessness prevent and manage their medical and physical conditions, to what extent are medical services utilized by this population and what are their experiences with them, and what are some of the social, physical, and structural barriers to these individuals receiving care that might relieve the need for emergent care. Data gathering methods will include participant-observation, semi-structured interviews, and photography with three groups of participants: people experiencing homelessness, people experiencing homelessness with a medical and/or physical condition, and medical care providers of people experiencing homelessness with medical or physical conditions.

(Oral Presentation, Session II, Room 206, 10:30 AM)

The Challenges of Transitioning into Adulthood

Kimberly Bonnette – Human Development

Faculty Mentor: Lisa Badanes

College is a time in a young adult's life that is full of exploration, including new opportunities to experiment with drugs and alcohol. The current study sought to better understand which college students were most at risk for binge drinking. We focused on two potential factors, namely being the personal fable and neuroticism. Personal fable involves feelings of uniqueness, omnipotence, and invulnerability. Neuroticism is a personality trait characterized by anxiety, depression, self-consciousness, self-doubt, impulsivity, and a hypersensitivity to criticism. We hypothesized that college students who endorsed a personal fable and neuroticism would be more likely to report binge drinking behaviors. This hypothesis was examined using four surveys in a sample of 83 undergraduates (54% female, 73% Caucasian, M age=22). Binge drinking behaviors were more likely to occur among older participants, males, and Caucasians. As expected, individuals who endorsed a personal fable were more likely to have been

intoxicated during the past two weeks. Specifically, participants who reported that they felt invulnerable to the negative consequences of risk-taking were most likely to engage in binge drinking behaviors. Interestingly, contrary to our prediction, individuals who were higher in neuroticism were less likely to report being drunk in the past two weeks. When all of our variables of interest were included in our model predicting binge drinking behaviors, only invulnerability was a significant predictor. Results suggest that intervention efforts aimed at decreasing binge drinking behaviors among college students should address individuals' misperceptions about the possibility of negative outcomes associated with risk-taking.

(Oral Presentation, Session II, Room 200, 11:45 AM)

Victim Blaming in Interpersonal Violence Situations: A Review of the Literature

Lindley Booth – Psychology

Faculty Mentor: Anna Ropp

This literature review focuses on the basics of victim blaming as well as reasons why society victim blames (Johnson, Mullick, & Mulford, 2002). Victim blaming is said to be a fundamental attribution error, meaning that individuals are held responsible for their certain situations without taking into account outlying factors. There are many different reasons for this error, such as the hindsight effect and previously held patriarchal values. Hindsight effect occurs when a person looks back on a situation and they see all the different ways that things should have changed or been different (Fischhoff, 1975). This contributes to victim blaming because individuals would look at a victim's situation and point out what that person should have done to prevent it, all the while forgetting that the victim had only foresight and could not predict the outcome of their predicament (Fischhoff, 1975). Furthermore, McGrath, Johnson, and Miller (2012), found that in rural areas there are issues of previously held patriarchal values. Patriarchal values are the beliefs that men should be the governing part of society. It was found that those who hold higher patriarchal values, as well as strong religious beliefs were more likely to victim blame or be an abuser themselves. Perceptions of interpersonal violence are not to be taken lightly. The research presented found that victim blaming makes a victim less likely to come forward, which can hinder their healing process. Victims are also less likely to seek assistance or leave their situation (Mulford, Lee, & Sapp, 1996). According to Alicke, Buckingham, Zell, and Davis (2008), victim blaming also arises from the desire to find explanations for unexpected events. Given this information, victim blaming is not an issue that should be overlooked.

(Oral Presentation, Session II, Room 200, 10:30 AM)

Study in Orbital Debris Mitigation and Collection Techniques

Ryan Borys – Aviation Technology

Faculty Mentor: Jose Lopez

The current space environment is being congested by fields of non-maneuverable debris left over from collisions, fragmentation of upper stages of launch vehicles, nose fairings, and anti-satellite weapons tests. The amount of debris in orbit increases with every launch; by 2030 the amount of tracked debris will triple, clogging our routes to and from Low Earth Orbit (LEO.) This situation, if left unaddressed increases the likelihood of a Keesler Effect; a cascade of collisions each increases the probability of future collisions, rendering LEO unusable and impassable, effectively cutting off further space operations and explorations. The economic effects are devastating and the damage to future science is irreparable. Recent advances in space craft that can reach LEO have provided an elegant solution for the removal of these dangerous pieces of debris. Utilizing the industry standard software Systems Tool Kit (STK) by developer

Analytical Graphics Inc. and robust research methods, we can create situational based scenarios for finding the best techniques and routes for collecting orbital debris safely and efficiently. Through these scenarios students will understand the feasibility of utilizing reusable spacecraft to collect and recover debris and potentially return it to Earth or move it to another celestial body. This scenario is used to determine how to collect orbital debris as it has never been done before, as well as offer a larger than average margin for error due to the isolation provided by navigable satellites avoiding the debris fields. The study will be able to provide a timeline for how long it would take to remove orbital debris from densely populated areas of near earth space, as this study is still in progress.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #13)

Ascl1 and Lmo4 Interactions That Drive Gene Regulation in Neurogenic Development

Kyra Brandt – Chemistry

Coauthor: Sarai Graves

Faculty Mentor: Andrew Bonham

The development and growth of neurons in the human brain is highly controlled to ensure proper maturation. These processes are largely regulated by proteins known as transcription factors that turn on and off specific genes. Interactions between these proteins are known to have large functional consequences, but the detailed kinetic and thermodynamic parameters that ultimately decide cell state remain unclear for many protein systems. This is of particular interest to understand differentiation and genetic disease, such as the mechanisms by which the proteins Ascl1 and Lmo4 direct neuronal commitment. Ascl1 is expressed in high concentrations in cancers such as medullary thyroid and small cell lung cancer and is potentially useful in detecting early stages of these diseases. To explore the common mechanisms by which these systems control gene expression, we have generated sensitive, DNA-based biosensors for the assessment of the DNA-binding activity of these significant proteins. The proteins were cloned in a plasmid, expressed in bacteria, purified, and confirmed on a western blot. Ascl1 binding activity was probed using novel DNA biosensors and found to have an affinity of 108 nM. Investigations have begun on the effects of Ascl1's binding partner, Lmo4, to understand how these interactions control DNA binding specificities. Using these sensors to investigate recombinant protein systems will provide a greater mechanistic understanding of the effect of these interactions on their regulatory activity and functional consequences in the cell.

(Oral Presentation, Session II, Room 204, 11:00 AM)

Conferring Temperature Adapted Function by Rational Protein Design

Aviva Bulow – Mathematics

Coauthor: Stanley Howell

Faculty Mentors: Kenneth Prevot, Corey Wilson

Every enzyme has a relatively narrow temperature range, where it is warm enough to maintain the flexibility needed for function, but cool enough to remain stable. Thus, we must be able to reliably manipulate the thermal profiles of the enzymes we wish to design in order to ensure that they will be viable at the temperatures at which we wish to use them. Here we use rational computational protein design [1] to generate ten variants of *E. coli*'s adenylate kinase (ecADK), which have improved thermostability when compared to the wild type. We model replacement of target residues in the protein core and repacking of neighboring side chains with the goal of maximizing Van der Waals interactions.

The increased number and strength of the interactions within the core of the protein serves to confer stability to the structure without adversely affecting the basic functionality of the enzyme. We give each design a predicted stability score, we then synthesize and characterize the top ten. In this study, design was facilitated by the successful redesign of adenylate kinase from *B. subtilis* (bsADK) [1], which benefited from the utilization of sites sensitive to thermal adaptation identified by Couñago et al. [2, 3, 4]. ecADK and bsADK have similar structures but divergent sequences. Using this structural similarity we identified the homologous design targets that bestow ecADK with enhanced stability.

(Oral Presentation, Session II, Room 203, 10:45 AM)

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(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #1)

The Efficacy of Licorice Root Against Oral, Respiratory, and Gastrointestinal Microorganisms

Megan Burke – Biology

Faculty Mentor: Sheryl Zajdowicz

Ancient Egyptian, Greek, Roman, and Chinese cultures all valued licorice root for its diverse medicinal uses, and it has appeared in written medical texts since 2100 B.C. As bacteria develop resistance to some of the most commonly prescribed antibiotics and frequently used antiseptics, the need for an alternative is crucial. Previous research suggests that essential oils concentrated from a variety of culinary herbs could be effective alternatives to antibiotics, and we predicted that licorice root would have antimicrobial properties. This study evaluates the antimicrobial efficacy of licorice root against both Gram-positive and Gram-negative organisms known to cause oral, respiratory, and gastrointestinal illness. Representative bacteria were plated on Mueller-Hinton agar and exposed to licorice root extract, pure licorice root tea, or licorice root capsules. The results showed that licorice root extract successfully inhibited the growth of common oral microbes, including *Streptococcus sanguinis*, *Streptococcus salivarius*, and *Lactobacillus*

casei, that are associated with dental caries formation. Further analysis of the efficacy of licorice root against other oral, respiratory, and gastrointestinal organisms is in progress.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #6)

Gram Positive Isolate Inhibits Growth of a Gram Negative Bacterium

Krista Burney – Biology

Faculty Mentor: Rebecca Ferrell

A bioreactor in the lab was contaminated with two unknown species of bacteria that showed a relationship in which one organism inhibited the growth of the other. Pure cultures of both were obtained by 3 rounds of isolation streaking, and tests were conducted to discover the nature of this relationship. The inhibitor organism is a Gram positive rod, while the bacterium on which it acts (“background organism”) is a Gram negative rod. We tested the inhibitor against 12 additional species of bacteria, and saw no inhibition of their growth, indicating that there is specificity in this relationship. Spent medium from the inhibitor did not reduce growth of the background organism on solid media. However, growing both organisms in liquid medium (inoculated with either equal OD600 units of both, or 2X background organism to inhibitor) and then plating on solid medium revealed that the inhibitor comprised nearly the entire culture after overnight growth. We have isolated chromosomes from both organisms and amplified their 16S rRNA genes using PCR. Sequencing of this DNA will assist us in identifying these bacteria, and we are also continuing to investigate the mode of inhibition.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #7)

Tolkien's Issues with Narnia: Insights in the Divergent Artistic Visions of J.R.R. Tolkien and C.S. Lewis

Emily Butler-Probst – English

Faculty Mentor: Craig Svonkin

This study analyzes J.R.R. Tolkien’s philosophical vision as an author and how this vision impacted his judgment in the harsh critique he gave of an early draft of C.S. Lewis’ *The Lion, the Witch, and the Wardrobe*. This critique eventually resulted in Tolkien’s dismissal of the entire Narnia series, a ruling that wouldn’t change in spite of the eventual commercial success of Lewis’s books. The formative question for this research study was: What aspect of J.R.R. Tolkien’s own creative vision caused him to respond so negatively to *The Lion, the Witch, and the Wardrobe*? To answer this question I researched scholarly materials discussing Lewis and Tolkien’s writing processes along with Tolkien’s selected letters and his essay “On Fairy Stories.” These sources provided insight into Tolkien’s ultimate purpose for writing as well as his artistic vision. I then compared Tolkien’s artistic vision with Lewis’s. This research revealed that Tolkien and Lewis had differing reasons for writing within the fantasy genre. While Lewis hoped that Narnia could serve evangelistic purposes, Tolkien believed that the goal of writing was to create a believable secondary world. As a result, Tolkien may have shown disapproval of Lewis’ Narnia series because he believed that Narnia was lacking in sufficient detail to create a believable heterocosmic world which would have been considered a grievous oversight in Tolkien’s mind. These findings not only provide insight into Tolkien’s and Lewis’ divergent purposes in writing but also can help to offer a newfound appreciation for both writers’ works, allowing readers to recognize Tolkien’s meticulous effort in creating Middle Earth as well as Lewis’s allegorical retelling of the Christian gospel message in *The Chronicles of Narnia*.

(Oral Presentation, Session I, Room 203, 9:15 AM)

Human Trafficking in the United States: Analyzing Demand and Demand Reduction Strategies

Kayleen Campbell – International Relations and Criminal Law

Faculty Mentor: Amy Eckert

Human trafficking is an issue within the United States that continues to plague our society. In order to begin eradicating this crime, it is important to understand why it has prevailed for so long. On a demand-side analysis of the issue, factors such as media bombardment of all age groups with explicit sexual imagery and the normalization of sexism and objectification, pornography, prostitution and pimp culture, the patriarchal society in the United States which condones the objectification and dehumanization of women, and the demand for children are all contributors to the demand for human trafficking in the United States. Demand reduction strategies offered include a call for more funding to better enforce current abolitionist policy, the elimination of pornography, and the implementation by the United States government of the Swedish gender model, which criminalizes the men purchasing commercial sex rather than the prostitute. However, it is important to realize that policy change will be ineffective without a change in cultural and societal norms.

(Oral Presentation, Session I, Room 203, 9:00 AM)

Acid Rock Drainage, Mining, and Fluvial Geomorphology in Colorado's Mineral Belt

Christopher R. Carrington – Environmental Science

Faculty Mentor: Thomas C. Davinroy

This report was undertaken in an effort to understand how geologic, human processes and fluvial action effect water quality in the environment. Acid mine drainage, heavy metal pollution and salinity issues have always plagued Colorado and all other areas that have had an extended period of mining activity. These issues effect fish habitat and survival, drinking water, agriculture and countless other areas of our environment and daily life. These issues are not always caused by or dependent on propinquity to mining activity.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #4)

A Novel Investigation of Fungal Pathogens of Camel Spiders (Arachnida: Solifugae)

Patrick Casto – Biology

Coauthor: Jennifer Jennings

Faculty Mentor: Robert Hancock

Solifugae, commonly known as camel spiders, are a poorly studied order of arachnids that live in arid habitats. Arachnid hobbyists and researchers alike have tried for years to keep solifugids in captivity with very poor results. The majority of specimens in the lab die quickly of seemingly unknown causes. One possible culprit for this high mortality rate may be from fungal infection. Specimens collected of various species and locations across the U.S. have shown similar symptoms and similar types of infections. This project is the first known investigation of a solifugid pathogen. There are many fungi that infect

arthropods, many of which are being investigated and used for purposes of pest biological control, especially in agriculture. The fungal infection of arachnids may be an adverse biological control agent since most arachnids are predators of many insect pests; however, little research has been done on arachnid fungal pathology. GC-Mass Spec of a sample taken from a preserved solifugid shows the presence of common phospholipids found in cell membranes of eukaryotes. We have light micrographs of the fungal mycelium and one micrograph of possible conidiophores. PCR and electron microscopy were used to help elucidate the identities of the fungal pathogens.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #8)

Resource Need of Caregivers Interested in the Let's Move Child Care Recommendations

Maggie Chamberlain – Nutrition

Coauthor: Lyndsay Ellis

Faculty Mentor: Cynthia Dormer

Let's Move Child Care checklist promotes an evidence-based set of recommended practices for child care settings. These practices support children's development of healthy preferences. Little is known about child care providers' resource needs for implementing these best practices in their settings. At a child care providers' continuing education event, we advertised free support to caregivers interested in furthering implementing the Let's Move Child Care checklist practices. 11% of caregivers attending the educational event expressed interest. Twenty-nine child care facilities received follow-up support for Let's Move checklist items. Caregivers were able to choose which types of support they wanted as long as their resource request could be tied to the Let's Move Checklist recommendations. Resource needs categories, identified by caregivers and provided by the MSU Denver research team, were: Staff Development Training (n=17); Environment Change-Physical Activity (n=9); Environment Change-Nutrition (n=5); Children's Activities (n=13); Parent Outreach (n=3); Menu Change Support (n=2); and Written Policy Change Support (n=2). Follow-up assessment suggested that caregiver and child behavior changes were more sustainable following environmental and menu changes compared to staff development, parent outreach, or children's activities. Moreover, the two child care organizations initially interested in policy change both declined to print and distribute revised policies in their parent and teacher hand books. In conclusion, while more research is needed, results of this study point to challenges and promising avenues for supporting caregivers' implementation of Let's Move Child Care practices.

(Oral Presentation, Session I, Room 209, 9:30 AM)

Double-stranded RNA Synthesis for RNAi in *Tribolium castaneum*

Cheng Chang – Chemistry

Faculty Mentor: Emily Ragan

RNA interference (RNAi) is a mechanism by which double-stranded RNA can trigger the degradation of mRNA with a matching sequence, leading to silencing of the gene. The target of this research is to produce double-stranded RNA for injection into a type of beetle, *Tribolium castaneum*, to trigger a change in its eye-color. This double-stranded RNA will be a positive control used to help establish the use of RNAi in *T. castaneum* at Metropolitan State University of Denver. The gene responsible for eye pigmentation in *T. castaneum* is vermilion. The central part of this research is to successfully synthesize double-stranded RNA for silencing the vermilion gene. The research group used different methods along the way to achieve this goal, including E-RNAi, PCR, gel-purification, and a MEGAscript RNAi Kit. To identify a suitable region of the vermilion gene for double-stranded RNA, a web application called E-

RNAi was used. After designing primers to amplify the target region of vermilion, PCR was used to amplify vermilion cDNA template. PCR was followed by agarose gel electrophoresis and gel purification of the desired product. Based on the determined concentration, further PCR and gel-purification was performed to produce more DNA template. The last step will be to use the vermilion DNA template with the MEGAscript RNAi Kit to make dsRNA, which can then be injected into *Tribolium castaneum*.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #28)

Evaluating the Potential of Methoprene Resistance in *Culex* mosquitoes

Michael Clark – Biology

Faculty Mentor: Robert Hancock

Methoprene is a synthetic analog of juvenile hormone III, a hormone that regulates many insects' development and reproduction cycles. This study examines the factors surrounding methoprene resistance in mosquitoes, specifically in *Culex tarsalis*. A standard toxicity test was conducted on *C. tarsalis* to determine baseline lethal concentrations. Experiments tested how larval feeding habits or exposure levels affect mortality rates in *C. tarsalis*. Each test group was done in triplicate with 25 larvae in 500 ml of water in each 1 L beaker. Larvae used were at the 3rd or 4 instar of their life cycle. The study is still ongoing. Full results and conclusion will be presented at the conference.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #6)

2014 IEEE Region 5 Robotics Competition

Ric Clark – Electrical Engineering Technology

Coauthors: Matt Wicke, Pap Loum, Jamie Addler

Faculty Mentor: Megan Paciaroni

Our goal was to design a robot that could compete in this year's IEEE robotic competition in Corpus Christi. The challenge is to build an autonomous robot that could simulate navigating to an on fire oilrig and put out the fire while avoiding obstacles and staying on track. We are still in the process of finishing up the robot for April's competition, but have made good progress. The competition is timed and the fastest time through the course is the winner. We are using computer vision to detect a flame behind the oilrig that is on fire. Each oilrig has its own tool to put out the fire, so once we detect which needs to be extinguished, we will use computer vision again to make sure we have the correct tool using object recognition. Once the robot has the correct tool, it will autonomously navigate through the course to the oilrig. There are two sonar sensors that are being used for object avoidance and maneuvering along the simulated course. The robot has 4 independent wheels that each have direction control and motor control so that the robot can turn in place. A microcontroller and microprocessor are being used as the control system. We have spent a lot of time on this project and are hoping to place in the competition early April.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #14)

Subversive Cultural Silence and Non-Verbal Expression as an Implicit Narrative Strategy: Observations of Latina Women Writers Constitute a Signal of Feminist Uprising Against the Submissive Silence Measures Imposed by Patriarchy

Cristine de la Luna – Women's Studies

Faculty Mentor: Arlene Sgoutas

I will be applying the theory of subversive cultural silence based on Helene Weldt-Basson's Subversive Silences (2009) analysis of how Latin American Feminist writers have appropriated subversive silence and redirected it through fictional literary expression. It is through analysis of fictional literature that one develops a more complex understanding of Latin American women writers. Moreover, the application of subversive cultural silence as a narratological technique allows space for creative movement thematically and stylistically. Additionally, this form of linguistic appropriation is expressed in the form of naïve narrators, inverted icons, bilingual gaps, parody and hyperbole. This research further examines the manner in which acclaimed author Sandra Cisneros utilizes subversive cultural silence as an implicit narrative strategy to message a feminist perspective in her literary work. It is through extended observations of her work in *The House on Mango Street* and *Woman Hollering Creek and Other Stories* that Cisneros expresses a distinctive female sphere of experience. Moreover, the iconic location of Latinas and their articulation into commodity culture are both gendered and racialized--- that is, each woman's identity underscores her racial individuality and how she fits gender norms. Although the images differ substantially, in each case emphasis is placed on women's status as others who contrast in significant ways from dominant American society. Overall, Cisneros highlights images of Latina icons that emphasize their hybridity (i.e., their social class as hybrids). Hybridity refers to the distinct cultural identity that emerges from mixing culture or identities. The author implies that Latina women do not fit into long-standing U.S. racial categories of black or white, and therefore have the potential to threaten established U.S. cultural assumptions about race and gender.

(Oral Presentation, Session I, Room 200, 9:30 AM)

Early Skin To Skin Contact Between Mothers And Infants Can Promote Exclusivity Of Breastfeeding

Brian DeCanio – Nutrition

Faculty Mentors: Jennifer Weddig, Michelle Tollefson, Heather Thompson

Despite known benefits, breastfeeding rates are lower than desired ("American Academy of Pediatrics (AAP)," 2005). Skin-to-skin contact (SSC) of the baby with its mother's bare chest, immediately after birth until the first breastfeeding attempt has been shown to have a positive impact on breastfeeding (Bramson et al., 2009; Moore & Anderson, 2007b; Moore, Anderson, & Bergman, 2007a). This study seeks to find if there is a relationship between continued SSC during the first 72 hours of life and improved breastfeeding exclusivity and duration at 3 months, 6 months, 9 months, and 12 months. The study population is women who delivered infants at a free-standing birth center (MMC). The study consists of the development, pilot testing and administration of a survey to collect data regarding the effect of continued SSC on breastfeeding exclusivity and duration. The survey was reviewed by a group of experts in the field of maternal and child feeding to establish face validity. The survey was then updated to reflect the changes recommended by this group and pilot tested by a small group of patients (n=20) who delivered their infants at MMC over the last year. At this time statistical analysis is being conducted to establish the validity and reliability of the survey. Once this has been established, the survey will be

administered using Survey Monkey to the 1980 families who have given birth at MMC over the last 3 years.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #10)

Simulation of Self-Inductance in a Superconducting Square Coil

David Dran – Physics

Coauthor: Denny Shunk

Faculty Mentor: Richard Krantz

The Cryogenic Dark Matter Search (CDMS) is an experiment designed to directly detect particles called WIMPs (weakly interacting massive particles) which are theoretical particles thought to comprise the dark matter in the universe. In theory, WIMPS can interact with the lattice of a solid germanium crystal held at sub-Kelvin. The very small signals generated by these interactions in the cryogenic environment must be amplified so that room-temperature electronics can detect them. The creation of this amplification involves inductively coupling a coil to a Superconducting Quantum Interference Device (SQUID) and building an array of these combinations to create an amplifier that can work at superconducting temperatures. With the preceding in mind, modeling the inductance of the superconducting coil is important to this design, so that we can understand the frequency response of the SQUID circuit. We investigate the use of the imaginary conductivity derived from the two fluid superconducting model applied to COMSOL modeling software, a physics modeling application which uses Finite Element Modeling (FEM) methods. We then create a three dimensional model of a five-turn square coil using COMSOL and calculate the self-inductance derived from the simulation. Next, we compare the resulting self-inductance from the simulation to the experimental evidence given by Hines et al., which reports the self-inductance for an array of ten-turn coils of a similar design. Lastly, using this COMSOL model, we investigate the effect of using a superconducting flux focusing “washer” with the coil in our simulation and compare the results with normal and superconducting materials.

(Oral Presentation, Session II, Room 203, 10:30 AM)

Veterans Experiencing Homelessness: Prevalence, Problems, Programs, and Proactive Suggestions

Genevieve Eigner-Ettelman – Psychology

Faculty Mentor: Linda Marangia

In light of the growing concern for homeless veterans, the Social Change class of Dr. Linda Marangia conducted exploratory research under the Colorado Charge research initiative to elucidate the current state of his vulnerable population. This research highlights the historical treatment and reintegration of veterans, and outlines existing programs serving this population, in addition to making suggestions for future research on this topic. Historical document analysis was used to reveal how veteran experiences varied for the cohorts of World War I, World War II, the Vietnam War, the Gulf War, and the Iraq War upon their re-entry into civilian life, which had an impact on their becoming homeless. Because of their age, physical illnesses, mental illnesses and difficulty in reintegrating into society after leaving the military, homeless veterans experience more difficulties than the non-veteran homeless population. There are numerous programs which assist homeless veterans in learning civilian job skills, obtaining jobs, obtaining basic necessities (e.g. clothing), finding both temporary and/or permanent housing, receiving medical care, receiving psychiatric care, receiving drug and/or alcohol treatment, as well as programs which specifically focus on reducing the veteran homeless population. Despite these programs, there still

remain over 17% of homeless people who are veterans, so the concern prevails for this population. Future research concerning the experiences of veterans who are homeless, as well as why certain programs have been more successful than others, would be useful in determining how to further help this vulnerable population.

(Oral Presentation, Session II, Room 206, 11:00 AM)

Game Theory of Cutthroat Kitchen

Amanda Ellison – Psychology

Faculty Mentor: Lesley Hathorn

Cutthroat kitchen is a reality television show where four chefs compete against each other for three rounds. Each round consists of a different dish to be cooked. Several sabotages are auctioned off before the cooking begins. Each chef starts with \$25,000 to use in the auctions. At the end of each round one chef is eliminated for producing the worst dish. The chef who wins three rounds wins the money that chef has remaining. The outcome of the game is uncertain because of the sabotages and skills of the chefs. This study examined game theory models for Cutthroat Kitchen. Game theory takes on a wide range of applications from economics, warfare, and psychology. A game is simply a set of strategies that players or opponents can use to quantitatively describe their choices. Our study looked at non-cooperative dominate strategies a player could use to avoid deleterious outcomes. Participants on the show included 30 men and 22 women. In general, there was no significant difference in the dollar amount won between men or women. Men and women bet similar amounts in the first and third round. However, men bet significantly more aggressively in the second round ($p = .037$), spending twice as much as women to win the auction. Consequently, they also won more auctions in the second round ($p = .024$). The average amount won per episode was \$10, 838. Winners did not bet significantly differently from losers. Consequently, skill appears to be the single most dominant factor in winning.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #3)

The Integration of International Accounting within Collegiate Accounting Curricula in the United States

Frank Erickson – Accounting

Coauthor: Kyle Matese

Faculty Mentor: Andrew Holt

This research investigates the way that collegiate accounting curricula have changed in response to the recent push for use in the U.S. of International Financial Reporting Standards (IFRS). By analyzing the accounting curricula of a significant random sample of 322 U.S. colleges and universities, we will determine the level of attention paid to the study of IFRS and international accounting within U.S. academic system. Data from online college catalogs will be analyzed to determine if each institution has a dedicated international accounting course or if IFRS instructional material is integrated within traditional accounting classes. With the planned convergence between U.S. GAAP and IFRS, our hypothesis is that a significant portion of colleges will have separate courses dedicated to IFRS and international accounting.

(Oral Presentation, Session I, Room 209, 9:15 AM)

Groundwater Flow Tank

Ernest Espinosa – Environmental Science

Faculty Mentor: Uwe R. Kackstaetter

The purpose of the Groundwater Flow Tank (GWFT) is to provide a physical and visual tank that will offer the faculty and students at Metropolitan State University of Denver (MSU Denver) an additional tool to assist current and future students in learning the dynamics of hydrology and hydrogeology. The GWFT will allow MSU Denver faculty to challenge students with actual real world experience in confined/unconfined groundwater aquifers. . The GWFT can be used to help in advancing the students understanding of groundwater variables such as: well construction, variable and constant flow rates, pumping, cone of depression, permeability, porosity, bulk density, and other course concepts. The central research question addressed the fundamentals of how to help future Environmental Scientists better understand the dynamics of groundwater aquifers. The methods used to construct the GWFT began with combining theoretical knowledge in hydrology and hydrogeology. The original design of the tank and tank stand was constructed out of an acrylic plexiglass manufactured by Plaslabs. The aquifers media was sifted to a specific mesh and all organics had been removed during this process. The wells and pumps were selected to fit the dynamics of the aquifer experiment. The preliminary finding of the research has caught the attention of various organizations on MSU Denver's campus. The current outcomes can be viewed at: 1. <https://vimeo.com/85396790>, 2. <https://vimeo.com/86154435>, 3. <https://vimeo.com/86383266>. The research has proved to be very successful and promising for the unconfined aquifer model. Therefore, I would like to continue my career helping others understand environmental science.

(Oral Presentation, Session II, Room 204, 10:45 AM)

Healthy Weight Models and Body Dissatisfaction

Christine Evans – Psychology

Faculty Mentor: Pamela Ansborg

Exposure to models who represent the thin ideal in beauty and fashion magazines can potentially lead to greater body dissatisfaction, especially in women and those who have suffered with an eating disorder. One study found that 87% of magazine models are below average weight and therefore unrepresentative of average women in society (as cited in Vaughan and Fouts, 2003). In response to critics, Vogue magazine recently announced that it would only include healthy weight models in their advertisements. The current research investigated the effect of the announcement on body dissatisfaction. It was assumed that the models, who are still thinner than typical but now labeled as healthy, would promote greater body dissatisfaction. The control and experimental group consisted of seven and eight female college students respectively. Participants' ages ranged from 18 to 48 years ($M=23.73$, $SD=9.40$). At the beginning of the session, the experimental group was told about Vogue's announcement. The researcher told participants, "Vogue has made an announcement to no longer use models who appear to have an eating disorder in their magazines." The control group was not told about the announcement. Both groups viewed the same series of magazine advertisements and then completed the EDI-BD. No statistical significance was found in this pilot study. However, limitations included a small sample size due to time constraints and much smaller images compared to those actually found in magazines. Further research is needed for more accurate insight into the effects of Vogue's announcement.

(Oral Presentation, Session III, Room 200, 3:15 PM)

Normative Trends

Christine Evans – Psychology

Faculty Mentor: Chad Mortensen

Research has shown that norms can influence conservation behavior (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) and they are more influential if they are thought to be more popular (Milgram, Bickman, & Berkowitz, 1969). Additionally, Alter and Kwan (2009) found that people from western cultures assume that observed trends will continue in the same direction. Therefore, if a norm is increasing in popularity, people should expect that trend to continue, making that norm more influential. Better insight into such normative trends could have great implications for promoting more environmentally friendly behavior. The current research investigates the effect of using normative trends on water usage. The regular norm group consisted of 16 college students and the trending norm group consisted of 19 college students. The regular norm group read a message stating “Research from 2012 has found that 63% of MSU Denver students engage in one or more of the following water conservation behaviors” and the trending norm group read the same message, followed with a trending message, stating “This has increased from 52% in 2011.” In an ostensibly separate study, both groups were then asked to brush their teeth as part of a toothpaste taste-test study. Their water usage was covertly measured. The trending norm group showed significantly less water usage ($M=.45$ gal, $SD=.25$) than the regular norm group ($M=.69$ gal, $SD=.43$), $F(1,33)=4.52$, $p=.04$, $\eta^2=.12$. Further research should be conducted on the influence of normative trends when only a numerical minority of people are engaging in a behavior.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #17)

Trans* Experiences with Dating

Megan Fowler – Psychology

Faculty Mentor: Carol Quinn

Trans* Experiences with Dating is an ongoing research project which aims to collect both qualitative and quantitative data on the experiences of trans* people in past and present romantic and sexual relationships. The term “Trans*” includes transgender, transsexual, genderqueer, and other non-binary gender identified people. Data is being collected via an online survey and we currently have over forty responses. The significance of the research is to add to the extremely limited research on these communities and to help develop a clearer understanding of the dating experiences of trans* people. Questions in the survey focus on six areas, which include identity, community support, relationship history, behavior around gender identity disclosure, violence experiences in daily life and in relationships, and stereotypes that participants have personally experienced or have heard about members of their community. The study intends to look at how pieces besides gender identity interplay in a person’s experiences. Based on anecdotal accounts found on transgender dating websites and blogs, we expect to find that trans* people experience stereotypes, discrimination, and interpersonal abuse including bullying and rape, and that they have developed strategies and skills to navigate the dating world. We also expect that there may be differences in these experiences between different trans* communities. We intend to analyze patterns we find in dating experiences not only in terms of being trans*, but in belonging to a specific community beneath that umbrella and to compare those experiences between communities. We will share preliminary results of the study with the audience, field questions about the study itself, and talk about strategies for continuing research. A basic understanding of trans* communities may be helpful to have before hearing the presentation, and an introduction will be given.

(Oral Presentation, Session I, Room 200, 9:00 AM)

Sterility Testing of an Improved Tooth Storage Solution

Jayson Frederick – Biology

Faculty Mentor: Sheryl Zajdowicz

Dental students routinely use extracted human teeth to practice techniques used in dentistry, potentially putting them at risk of infection from residual microorganisms on the tooth. Infection control is imperative; therefore, the need for a storage solution that sterilizes the tooth, as well as maintains the structural integrity of the tooth, is needed. The Carey Tooth Storage Solution is a novel tooth storage solution that contains antimicrobial components and hydroxyapatite; we propose that the components of the Carey solution will sterilize teeth and will not result in dissolution of the tooth enamel. In the present study, the efficacy of the Carey Tooth Storage Solution was determined. Freshly extracted teeth were exposed to the Carey solution for a period of seven days at 40 C. Following exposure, the solution, the exposed teeth, and their root pulp, were evaluated for microbial presence by plating in brain-heart infusion agar, and through filtration of the solution. Incubation of the exposed teeth and the filter yielded no microbial growth, suggesting that the Carey Solution is effective in sterilizing extracted teeth. Additionally, U.S. Pharmacopeia (USP) bacterial and fungal standards were used in bacteriostasis and fungistasis analysis to confirm the bactericidal nature of the solution. The results showed that the Carey Tooth Storage Solution is effective at sterilizing teeth and that the loss of growth was not due to a bacteriostatic effect. Finally, the killing efficiency of the Carey solution was assessed against USP standards and determined that sterility resulted within 24 hours or less of exposure.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #5)

Directed Design And Synthesis Of Novel Asymmetric Bent-Core Mesogens

Alicia N. Gamble – Chemistry

Coauthor: David M. Walba

Faculty Mentor: Ethan Tsai

The field of liquid crystals (LCs) has garnered much interest recently due to their potential applicability to molecular electronics, such as organic photovoltaic cells and field-effect transistors. Since shape induces certain LC phases, many different shapes of LC molecules have been investigated to find novel phases and properties that are pertinent to rising technology. In this research conducted, “hockey stick” -shaped LCs were designed by introducing a truncated asymmetric bent-core with a perfluoro tail that would induce de Vries phases. De Vries materials show strong candidacy to out-perform the traditional ferroelectric display materials. Initial exploration of these hybrid hockey stick de Vries materials shows interesting electro-optic and x-ray results.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #2)

Uncovering the Truth: A Study of the Mysterious Character Julián Carax from The Shadow of the Wind (La sombra del viento)

Gabrielle Garneau – Modern Languages

Faculty Mentor: Maria Rey-Lopez

The Shadow of the Wind (La sombra del viento, 2001) by Ruiz Zafón is an intricate narrative of its main character Julián Carax. The novel is woven together so mischievously that reality and fiction seem one and the same. The reader is left with a tremendous tale which begs the question, “who really is Julián Carax?” This bilingual study uses the poignant reflections from the fictional autobiography of Rosa

Montero, *The Crazy Woman Inside Me* (La loca de la casa, 2003) to untangle the web created by Ruiz Zafón. Through Montero's reflections, the reader is able to see how Carax created himself through the memories that make up *The Shadow of the Wind*. By applying Montero's idea that one person embodies multiple lives, the reader understands the different lives Carax perceived in himself. Through studying Montero's perspective on immortality in writing, they feel Julian's struggle to hold on to certain parts of his life. Even though Carax will forever be enveloped in shadow, by using Rosa Montero's ideas to analyze *The Shadow of the Wind*, the reader is finally able to understand part of the true character of the mysterious Julian Carax.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #13)

Where's the Ketone?

Lisa Giacomini – Chemistry

Coauthors: Daniel Hanson, Anthony Sylvester

Faculty Mentor: Russell Barrows

The purpose of this pedagogical research is to demonstrate the importance of intermediates involved in organic syntheses by developing a meaningful laboratory exercise. This research focused on the Grignard reaction, which is an organometallic reaction in which an organomagnesium compound (Grignard reagent) adds to a carbonyl group resulting in an alcohol. The success of predicting the outcome of chemical reactions is largely dependent on determining the reactivity of intermediates. When students are asked to predict the outcome of an 1:1 ester-Grignard synthesis, most will suggest a ketone product, which is incorrect. The reactivity of the intermediate ketone, which leads to the tertiary alcohol is much higher than that of the ester and only half of the ester will react resulting in a 50:50 ratio of starting ester and alcohol product. To demonstrate the importance of intermediates formed during Grignard reactions, 1eq. of methyl benzoate was reacted with 1eq. of the methylmagnesium bromide, and 1eq. of methyl butanoate was reacted with 1 eq. of the methylmagnesium bromide, using various reaction conditions involving different temperatures, solvents and sublimation of iodine. After the ideal reaction conditions were established, the Gas Chromatograph/Mass Spectrometer analysis of both reactions showed nearly a 50:50 mixture of starting ester and tertiary alcohol product. Therefore, once the ketone intermediates were formed they immediately reacted with the Grignard forming the corresponding tertiary alcohol products. The research resulted in the development of a dependable laboratory experiment to serve as a learning activity for undergraduate organic chemistry students.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #4)

Automated Device to Orient and Open Carriers

Omar Gomez – Mechanical Engineering Technology

Coauthors: Jeffery Carruthers, Steven Wolf, Rachel Mantych

Faculty Mentors: Mingli He, Lynne Zhao-Bowden

Swisslog, a leader in automation systems, has pioneered the design of pneumatic tube systems used in the healthcare industry to efficiently transport items within hospitals. Carriers containing test specimens, drugs, and documents travel through these tube systems and are delivered to various tube stations located throughout the hospital. Users then retrieve the carriers from a collection bin and manually open them to gather the contents. To help improve the workflow efficiency and ergonomics for users, Swisslog has sponsored a research project to determine a method of automating the carrier opening process. The presented design solution is an electro-mechanical system incorporating the use of stepper motors, liner

actuators, electronic controls, and the associated mechanical support structure. This system positions and opens a carrier automatically allowing the user access to its contents. The design approach includes the use of engineering analysis, 3D computer models, design schematics, concept sketches, material analysis, and cost calculations. As a MET Senior Design Project the work spans two semesters and includes a proposal phase and construction phase. Having gained approval of the design proposal in Fall 13', the project is currently in the final stages of construction. A working prototype is scheduled to be presented to Swisslog at the end of the Spring 14' semester. The resulting design concept will be evaluated by Swisslog and could potentially be incorporated into a new commercial product offered as an accessory for their tube stations.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #24)

Determining if Molecular Differences Exist Between Geographically Distinct Populations of *Pyrgulopsis kolobensis* in the Great Basin Region Watershed and the Upper Colorado Region Watershed

Stephanie Gomolka – Biology

Coauthor: Patty Moreno

Faculty Mentor: Hsiu-Ping Liu

Pyrgulopsis kolobensis, commonly known as the springsnail, is widely found in the Western and Southwestern United States. Snails of the species live in fresh and brackish water, and are included in the largest genus of freshwater gastropods in North America. Two areas in which *P. kolobensis* are found are the Great Basin and the Upper Colorado Basin Regions. The Great Basin Region, which is bordered by the Colorado watershed on the East and South, is an endorhedic watershed, a closed drainage system. Likewise, the Upper Colorado Region of this watershed is endorhedic. The two watersheds do not drain into one another, yet are geographically close and ecologically similar. In this study, we sampled 5 populations of *P. kolobensis*. DNA was extracted, mitochondrial cytochrome c oxidase subunit I gene (COI) amplified, sequenced and analyzed. The segment that is being amplified is 658 base pairs in length. COX1 is a gene, encoding for the cytochrome c oxidase I protein, which is often used to identify specific species of springsnails. This is due to the high mutation rate of the gene. One of these populations in the study was found in the Colorado Region, where as the remaining four were from the Great Basin Region. The purpose of this study is to determine if the snails found in the Colorado Region are the same or a different species from the snails found the Great Basin Region.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #9)

Testing the Intermediate Disturbance Hypothesis in a Lotic Ecosystem Following Catastrophic Flooding in Boulder, Colorado

Stephanie Gomolka – Biology

Faculty Mentor: Christopher Cooley

In September of 2013, the City of Boulder, Colorado experienced what many individuals call the 100-year flood. Boulder Creek, a freshwater creek and part of the St. Vrain tributary which runs throughout the city and outskirts of Boulder, is known for its beauty and abundance of vegetation, fish, macroinvertebrates and microinvertebrates. The 43.56 cm of rainfall that fell continuously from September 9, 2013 through September 16, 2013 devastated Boulder Creek, causing it to run at excessive speeds and to flow off the banks into residential, commercial, and prairie areas. Consequentially, due to the severity and speed on onset, the floods compromised both the vegetation and freshwater species found

in the creek. This four week study aims to determine if a major disturbance, such as this flood, results in increasing species diversity over a four week post-flood period. In 2013 on October 27, November 3, November 10 and November 20 intermediate sized rocks were removed from South Boulder Creek and analyzed for invertebrate species. Fourteen taxonomic groups and 254 individuals were recorded. The hypothesis was lightly supported: the creek did show signs of recovery and greater species diversity over a four week post-flood period, although it cannot be directly attributed to the disturbance alone.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #5)

The Waste that Saves: Bio-Gas a Green Alternative Energy

Anthony Groome – Mechanical Engineering Technology

Coauthors: Jake Erdman, Derek Clough, Kevin Clough

Faculty Mentor: Aaron Brown

Today's global energy supply is dependent on fossil fuels like crude oil, coal, and natural gas. These are non-renewable resources, and based on current reliance, their depletion is a major humanitarian and environmental issue. Bio-gas is a potential source of energy that can replace the use of non-renewables in a variety of applications. Some of the simplest uses of bio-gas are cooking and lighting. Bio-gas is produced through an anaerobic process that converts kitchen, yard, and animal waste into a useable and renewable resource. In the developing world, bio-gas can be especially useful. It can replace wood as a fuel source, as wood is often in short supply and a contributor to indoor-air pollution. Bio-gas burns with a clean flame and, when used in conjunction with an improved stove, it can nearly eliminate harmful indoor-air pollution. Studies have shown that women and children in the developing world are especially vulnerable to the health hazards of indoor-air pollution. It is a major cause of respiratory and eye disease – responsible for an estimated 1.6 million deaths each year. Furthermore, the reduction of time-consuming fuel gathering allows for devoted to other community activities, improved educational attainment. Moreover, bio-gas can help prevent the modification of land through deforestation and soil erosion as the demand for wood decreases. This research project is a small-scale, proof-of-concept demonstration bio-gas producer. The project team designed, built, and tested an anaerobic digester with readily available components that processed kitchen waste and cow manure. The digester produced enough bio-gas to power a small, improved stove. Facing the challenging phenomena of global warming and environmental destruction and their negative humanitarian impact. An appropriate energy technology like bio-gas is worth investigating. This project shows it is viable and easy to do.

(Oral Presentation, Session I, Room 206, 9:15 AM)

Introductory Nutrition Concepts as Perceived by College Students and Professors

Lindsay Gulley – Nutrition

Faculty Mentor: Ann Diker

Objective: Identify introductory nutrition concepts perceived by college students and professors as easiest and most difficult, concepts professors consider imperative, and strategies students recommend for understanding difficult concepts. Design, Setting and Participants: An anonymous survey asked students (n=167) to identify easiest concepts, most difficult concepts, and strategies to improve learning of difficult concepts. A similar survey asked professors (n=14) to identify easiest and most difficult concepts for students and most critical concepts in the course. Outcome Measures and Analysis: Iterative thematic content analysis of responses and comparison of student and professor responses. Results: Concepts considered easy by students and professors included designing healthful diets and the relationship

between nutrition and health. Concepts perceived as difficult by both groups involved biological processes (e.g., digestion, metabolism). Concepts considered easy for some students yet difficult for others included macronutrients and micronutrients. Recommended intake ranges of macronutrients, their function and overall importance were easy for students while metabolism and chemistry related concepts were difficult. Understanding the importance of micronutrients was easy but differentiating between numerous micronutrients and their functions appeared difficult. Concepts and skills considered imperative by professors included macronutrients, micronutrients, critical thinking skills, and designing and analyzing diets. Strategies identified to ease understanding of difficult concepts included additional exposure to concepts with interactive materials (e.g. case studies, study aides) and more study time. Several online students indicated they would have preferred the in-class format versus taking the course online. Conclusions and Implications: Results suggest additional strategies are needed when covering digestion and metabolism concepts in introductory nutrition courses. Covering fewer concepts more in-depth with an interactive approach to allow additional exposure may be warranted.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #11)

Factors of Substance Use

Lisa Hamilton – Psychology

Coauthors: Santiago Suárez-Quiroga, Stella Klann

Faculty Mentor: Katherine Hill

This study seeks to understand possible correlations between substance use and three possible factors: parenting styles, peer groups, and levels of conscientiousness. We hope to use this information to predict possible future behavior. This experiment seeks to investigate three different factors that may be associated with drug use and abuse. Therefore, this project has three different hypotheses: Our first hypothesis predicts that if a person is surrounded by peers who frequently use drugs, then the individual will be more likely to use drugs. Our second hypothesis predicts that there will be a significant positive correlation between substance use and parenting styles: it is expected that authoritarian parenting style will be associated with higher levels of substance use/abuse. The third variable we are investigating relates personality. We predict that individuals who are low in conscientiousness are more likely to develop substance use problems compared to people who score high on conscientiousness. Data collection for this study involved one survey used for determining levels of substance use, and three other surveys each corresponding to the three hypotheses.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #16)

Predicting Potential Mine Tailings in Colorado for Rare Earth Elements Contained in Peralkaline Granite and Syenite

Paul Henderson – Environmental Science

Faculty Mentor: Barbara Echohawk

This investigation is ongoing research into exploration of mineral potential for Rare Earth Elements (REE's) in mine tailings within Colorado. This research focuses on locating mine tailings which is an economical and uncomplicated extraction of ore and is more favorable than the expensive and time consuming mining of a non developed deposits. This study specifically focuses on acidic alkaline rock, in particular, peralkaline granite and syenite as the host lithology containing rare earth metals. A Geographic Information System (GIS) has been used to combine spatial data obtained from the USGS Mineral Resources Program to construct a map predicting locations with possible REE content. Data used includes a digital geologic map of Colorado, fault data and location for Colorado, geophysical data such as

aeroradiometric survey data, a magnetic anomaly map and digital geochemical sample data. Values and conditions which are used to give evidence for REE potential are based on similar values found at locations containing rare earth metals nationally and internationally and known signatures for acidic alkaline rock which could be potential hosts to rare earth deposits. The spatial data sets used are in vector and raster form. The processes of vector overlay and boolean overlay were used, combining spatial data layers to find locations which meet multiple conditions thus giving evidence for favorable sites where peralkaline granite and syenite may contain rare earth metals. The combination of the spatial data layers produced a final map which can be used in field exploration of mine tailings for REE's.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #8)

Just a Night Out on the Town: Crime Analyses of a Major Metropolitan Entertainment Area

Taylor Henry – Biology

Coauthors: Ashia Grime, Marisol Gomez, Joe Colavito

Faculty Mentor: Denise Mowder

Recent Denver news media reported that violence in the lower downtown area (Lodo) has increased, culminating in the death of a Buckley Air Corpsman on July 13th, 2013. This area of Denver is an eight block square with approximately 40 bars and is known as the Denver "hot spot" along with being a mecca for crime. Students in a Criminal Justice Research Methods class studied the crime increase reported by the media and assessed its validity along with other contributing factors for violence in this area.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #19)

Male Mate Choice in Convict Cichlids (*Amatitlania nigrofasciatus*)

Alyssa Herrin – Biology

Coauthors: Marc Rockhold, Lauren McHenry, Danielle Lebsock, Kim Setnor

Faculty Mentor: Jennifer Gagliardi-Seeley

Most studies in sexual selection focus on female mate choice; however, in monogamous biparental organisms male mate choice may be equally important. Convict cichlids (*Amatitlania nigrofasciatus*), are Central American freshwater fish that are monogamous, and biparental. Males convict cichlids expend a lot of energy obtaining, and defending their territories along with their offspring and mate. Pair-bond formation significantly increased when the male was given a choice of more than one female (In prep). In this study, we will focus on male mate choice by determining which factors increase pair-bond formation. We predict that pair-bond formation will increase when two females are present compared to one female. In addition, female competition may further increase the rate of pair-bond formation. To test these hypotheses we will have four treatment groups: Control (1 female), Group 1 (2 females, no interaction), Group 2 (2 females, with female interaction, without male observation), and Group 3 (2 females, with female interaction, with male observation). After the acclimation period, females are separated into their own compartments, out of view from one another. The male has free range in the front of the tank to choose between the two females. Five observations of the male's location in the tank will be taken per day at least an hour apart for 2 weeks. The male's choice is defined as him spending at least 80% of the last 25 observations (5 days), on one female's side of the tank. Furthermore, we will film male courtship behavior for 20 minutes on days 1, 7, and 14 to confirm his choice of a female. We have just started our trials on this experiment and do not have enough data collected to analyze our results.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #15)

Biodiversity in an Urban Setting: Comprehensive Arthropod Population Sampling on a University Green Roof

Suzy Hiskey – Biology

Coauthors: Jennifer Jennings, Ted Heron

Faculty Mentor: Robert Hancock

Green roofs, building tops that are partially or completely covered in vegetation, have been used in Scandinavia since Medieval times. Use of green roofs has gained popularity around the world, including in the United States. They have been shown to reduce heat and rainwater runoff, filter pollutants, and provide a habitat for wildlife. The ecology and biodiversity of green roofs, especially in the western high plains of the United States, is an emerging field still lacking substantial research. This study helps in the understanding of what effect green roofs have on urban wildlife. The monitoring and assessment of arthropod biodiversity, is part of an interdisciplinary MSU Denver study regarding the green roof ecosystem atop the Student Success Building (SSB). It examines the arthropod fauna using multiple sampling methods on a regular schedule with the intent to determine the differences in diversity between the existing eco-zones on the roof; changes in diversity throughout seasons; and changes in diversity with the introduction of native plant species. The utilization of multiple sampling methods, including both active and passive traps, is necessary for an all-inclusive survey that takes into account diurnal and seasonal patterns. Active sampling methods include hand sampling, light sheets, and suction traps, and passive sampling methods include light traps, insect bowls, and pitfall traps. Sampling is being conducted with minimal disruption to ensure compatibility of the arthropod biodiversity survey with the overall interdisciplinary ecosystem study.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #9)

Factors Influencing Homelessness within the Transgender Population

Johanna Holmlund – Human Services

Faculty Mentor: Christopher Connor

The purpose of this research is to determine the specific issues that transgender people face when experiencing homelessness and identify possible solutions to improve outcomes for those who are homeless or vulnerable to homelessness. Transgender people face homelessness at a far greater rate than the general population, have less access to public assistance, and are more likely to experience discrimination, violence, and adverse mental health outcomes. The research explores the factors that lead to increased risk of homelessness among transgender persons, the unique difficulties they experience while homeless, the correlation between the criminalization of transgender identities and homelessness, and existing efforts to improve outcomes for transgender persons experiencing homelessness. Research indicates that multiple risk factors correlate with higher incidences of homelessness among transgender individuals; most notable are domestic violence, lack of family support, mental illness and addiction, and discrimination in education, employment, housing, and incarceration. Once homeless, transgender people have less access to assistance services and face more adverse outcomes including discrimination, violence, and attempted suicide. Some shelters are taking steps to protect transgender residents by enacting policies that respect gender identity and discourage verbal and physical violence. Many organizations and government programs are taking steps to reduce discrimination against transgender individuals. Finally, organizations are being created to directly assist transgender people experiencing homelessness. Further research is needed to identify the most effective ways of enacting positive change.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #24)

Hidden Symbols of Faith: Exploring Pagan Imagery in Medieval Christianity

Morgan Huston – History

Faculty Mentor: Kim Klimek

While Christianity was prevalent throughout medieval Europe, Christian beliefs and practices varied from location to location. Regional pagan customs and beliefs influenced and changed Christianity in interesting ways. Looking at religious art and saints from 500 to 1000, my research focuses on how local and pagan ideas were integrated into a new form of Christianity and I show how this integration helped to create a new medieval Christian belief structure that was palatable to early medieval Europeans. The integration can be seen as coming from the top down (church leaders), where it happened intentionally, and from the bottom up (local practitioners), where the integration was a natural blend of previous beliefs and Christianity. By understanding how local customs influenced early medieval Christianity, we gain a more nuanced understanding of the people of this distant and compelling time.

(Oral Presentation, Session I, Room 203, 8:45 AM)

E-DNA Sensor Development for the Sensitive Detection of the Potential Biological Warfare Agent Ricin in Foodstuffs and Blood

Travis Ingraham – Chemistry

Faculty Mentor: Andrew Bonham

Ricin is toxic protein produced in high concentrations in the seed of the castor oil plant, and can be easily extracted by rudimentary means in large quantities. As it has the potential to be used as a bio-terrorism agent, there is a pressing need for methods to quickly detect Ricin in water supplies, foodstuffs, and blood samples. We have developed a sensitive, electrochemical DNA bio-sensor (E-DNA sensor) directed against this target, based on synthetic Ricin-binding aptamer structures. These sensors give an easily measured change in electrical current in response to the concentration of Ricin present in a sample. Ongoing studies are evaluating the efficacy of this detection and the capability for real-world detection in complex media with low concentrations.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #19)

Comparison of Cartographic Symbols Representing Temperature

Victoria Ives – Land Use

Faculty Mentor: Stella Todd

Symbolic variation in data values is essential to cartography. An advantage of pictorial symbols is their ability to convey meaning about the object or event displayed. The symbol can be altered by changing the number and arrangement of sub-elements or by proportionally varying symbol size. The goal of this study is to test symbol perception and cognition of pictorial symbols that represent temperature variation. Through the use of a survey test subjects are asked to select heat intensities associated with various temperature symbols. Symbols with varying designs and counting mechanisms will be tested against each other and the accuracy of heat intensity selection will be determined.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #20)

Landscape Pressures on the Habitat Extent of the *Physaria bellii*

Victoria Ives – Land Use

Faculty Mentor: Sarah Schliemann

The *Physaria bellii* (Front Range Twinpod) is a flowering plant in the mustard family that is endemic to the Colorado Front Range area. The species is selective in its habitat range and is only found along the Niobrara Formation, which consists of both limestone and shale members. Although the twinpod is abundant in its population, it is listed as a G2 (imperiled) species on the Nature Serve's conservation list because of its extremely restricted habitat range. The already vulnerable *P. bellii* also faces pressures from the expanding Front Range population as well as other human activities such as limestone mining and the introduction of competing, invasive species. The purpose of this project is to isolate the preferred habitat of the *Physaria bellii* and the impacts of anthropogenic factors on this habitat's extent. Through the use of GIS, the twinpod's extent will be analyzed in both current and future contexts in order to determine the impact of human population growth and land use on the natural landscape, specifically regarding specialist/endemic species.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #10)

Business Financial Intelligence

Jessica Jaramillo – Computer Information Systems

Coauthors: Richard Bookman, David Garcia, Derek Englehorn, Muayad Abdullah, Mason Vidick

Faculty Mentor: Biswadip Ghosh

Our control of the company is the money flow between the internals of the company. We are to analyze and present where the money is being spent and how we can improve the financial status for our company.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #21)

Model Challenge Method: An Alternative Tactic in Damselfish Behavioral Studies

Jennifer Jennings – Biology

Coauthor: Aaron Bakker

Faculty Mentor: Robert Hancock

The use of model animals is a common tactic for studying animal behavior. However, in studying the behavior of the family of marine fish Pomacentridae, which includes the highly territorial group of fish known as damselfish, this is not a method often used. Instead fish are either placed into bottles for use or taken to labs for studying. In this experiment we look at the use of models as an alternative to the current methods. Antagonistic behaviors displayed to defend territory by *P. albicaudatus* were studied using a model challenge method off of the South Eastern tip of Kadmat Island, Lakshadweep, India in the Arabian Sea. Specifically we studied effects of pigmentation and anatomical detail on response of fishes to hydrodynamic models that were dropped in observed territories of adult *P. albicaudatus*. Selected *P. albicaudatus* were video recorded using GoPro II cameras. Two minutes of baseline was recorded before a randomly chosen model was dropped, response was recorded for 3 minutes. These videos were analyzed using the computer program Jwatcher, which quantified key behaviors defined by our ethogram as well as

image manipulating software to quantify territory sizes and movement. The recordings reveal several frequent behaviors of *P. albicaudatus* and established a pattern of antagonistic behavior towards intruders (the field models) in their territories. This coincides with the highly territorial manner observed in most species within the Damselfish family Pomacentridae. The model challenge method may be a viable alternative to study behavior in areas where removal of fish is prohibited.

(Oral Presentation, Session I, Room 204, 9:00 AM)

Administering Medical Marijuana: A Nursing Perspective

Rebecca John – Nursing

Coauthors: Lisa George, Grant Diegel, Yolanda Farmer

Faculty Mentor: Alexis Newton

Legalization of medical marijuana in Colorado has provoked a serious question regarding the legality of Registered Nurses administering medical marijuana as a treatment regimen in the home care setting. Patients who are mentally or physically incompetent must have medical authorization from a medical doctor and guardian in the form of a written order granting permission for nursing staff to administer medical marijuana. Administering medical marijuana without a written order may potentially jeopardize patient safety and the ultimately the nurse's license. Colorado State Board of Nursing states, "Absolutely no drug of any kind is allowed to be administered without a doctor's order or prescription while holding a Registered Nurse License." (DORA, 2013). This research encompasses a synthesis of information retrieved from the literature, using a case study format. An attempt will be made to answer the question: "Where do we go from here?"

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #13)

Presence of *Wolbachia* Symbionts in Mosquitoes Collected in Colorado

Erika Jonnsson – Biology

Faculty Mentor: Joanne Odden

DNA was extracted from mosquitoes collected at different locations throughout Colorado. The objective of this study was to analyze organismal host DNA to determine if *Wolbachia* symbiont populations were present. The experiment was conducted using DNeasy Tissue Culture kit for DNA extraction, PCR, and gel electrophoresis and analyzed based upon the band location and size that was obtained from gel electrophoresis. Approximately 20% of insects have *Wolbachia* symbionts; it is hypothesized that at least one of the four organisms will contain *Wolbachia*.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #7)

Beauty and Disclosure Rates: The Effect of Physical Attractiveness on Impression Management and Social Desirability

Chantry Joyce-Campbell – Psychology

Faculty Mentor: Pamela Ansborg

This study investigated how the physical appearance of a researcher influences the disclosure rates of participants on a self-report questionnaire. 60 undergraduate student participants completed the Marlowe-Crown Social Desirability scale. Before they started the survey, there were led to believe that they would be discussing their answers with either an attractive researcher or a plain researcher, or were told their answers would not be discussed. Two photos were attached to the questionnaire, one of an attractive researcher and one of a plain researcher. Both researchers were taken from a face database and were fictitious. The fake researchers were selected for how well they fit cross-culturally recognized standards of beauty (Perrett, May, & Yoshikawa, 1994). Participants who received a questionnaire with no picture were in the non-discussion group. Our hypothesis predicted that participants would disclose the least information to the attractive researcher, the most to the non-researcher group, and that the disclosure rates would fall in between for the plain researcher. However, participants on average disclosed the least to the plain researcher, slightly more to the attractive researcher and the most when they were told they would not be discussing their results. A subtle difference was found between genders; females disclosed least to the attractive researcher and more to the plain researcher while men disclosed more to the attractive researcher and less to the plain researcher. However, the differences were not statistically significant and both males and females still exhibited the highest rates of disclosure in the non-researcher group. These findings indicate that there is no significant effect of the researchers' physical appearance on participants' disclosure rates.

(Oral Presentation, Session I, Room 200, 8:45 AM)

The Mathematics Relating Pancakes and Spinpossible

Ethan Kowalenko – Mathematics

Faculty Mentor: Mona Mocanasi

Suppose you have some number of pancakes, all different sizes, and wish to organize them from biggest to smallest on your plate. Suppose also that your workspace is very small, so that your only option is to flip the pancakes on the same plate. How many flips would you need? As a simply stated problem, optimizing this procedure is a difficult issue. Furthermore, this problem has applications in biology (for flipping gene sequences) and computer science (for organizing data). In a seemingly unrelated problem, Spinpossible is a game where the player must flip tiles on a 3x3 board into the correct places, and in the correct orientation, which must also be optimized. In this talk, we'll discuss some common traits between these two distinct problems, and what these common traits may allow us to say about general solutions for them.

(Oral Presentation, Session II, Room 203, 11:00 AM)

Genetic Diversity of *Geum rossi* in the Colorado Tundra

Samantha Krause – Environmental Science

Faculty Mentor: Christopher Meloche

Alpine Avens (*Geum rossi*) is the most abundant and widespread plant species in the Colorado alpine tundra. It can be found in numerous communities across a large gradient of soil moisture and growing

season length. *Geum rossi* also undergoes an extreme pattern of preformation that is identical in all individuals across the gradient. Variation in morphology can be observed in the same species growing in a fell field, moist meadow and a dry meadow. The purpose of this research is to determine the genetic diversity of *G. rossi* in the 3 different communities, representing a two-fold difference in growing season length and a four-fold difference in plant size. Determining variation at the molecular level is a step in determining if habitat and growth differences are genetically determined or the result of plasticity in this species. DNA was extracted from individuals using a modified version of the abbreviated CTAB protocol. Then PCR amplifications were conducted to amplify three microsatellite loci specific to the genus *Geum*. Preliminary results are presented indicating some genetic diversity throughout this population of an important alpine species.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #21)

Effects of Acid Solutions on the Arbuckle Formation in Northern Oklahoma

Felicia Kruger – Land Use

Faculty Mentors: Uwe Kackstaetter, James Cronoble, Barbara Echohawk

The Arbuckle Formation produces oil in Kansas and Oklahoma. The scope of this study is to determine an optimal acid solution to dissolve oil bearing dolomite. Drill cuttings from the Maslen No. 6 well in the Vinita Oil Field in Craig County, Oklahoma from a depth interval of 590 to 665 feet were assessed for specific gravity and solubility. Additionally, sample eluates were analyzed with inductively coupled plasma mass spectrometry (ICP) to measure concentrations of dissolved elements. The acid tests were performed by submerging drill cuttings in HCl, HNO₃, H₂SO₄ and aqua regia solutions at various concentrations. Effervescence was observed during the first hour of the tests. After twenty-four hours, remaining samples were filtered, dried, and weighed and the effectiveness of the acids was assessed. 50% HNO₃ dissolved most of the samples but yielded a high amount of sludge-residue. HCl at the same concentration was not as effective in sample digestion. Sulfuric acid did not significantly reduce any sample even at a 50% concentration and was eliminated from the test series. It was found that 35% HNO₃ treatment followed by 10-15% HCl concentration should be an effective and an economical treatment for already existing and producing wells in the Arbuckle Formation. Results are also promising for application in other hydrocarbon-producing carbonate formations. The amounts and combination of acids in conjunction with biodegradable solvents could potentially be developed to fit the specific needs of well sites depending on composition.

(Oral Presentation, Session II, Room 204, 11:15 AM)

Tangibles vs. Intangibles: What is Important in Selecting an Outsourcing Vendor?

David Lauten – Computer Information Systems

Faculty Mentor: Biswadip Ghosh

The practice of sourcing information systems from outside vendors is growing. Worldwide IT outsourcing spending has grown to over \$800 Billion a year. As client companies move more towards today's environment of hosted solutions and out-sourced staffing, this also means selecting vendors across multiple technology and business functions. Vendor selection and management has become a major IT function for most organizations. As the types of information technology and the variety of IT vendor capabilities grow each year, IT vendor selection is becoming a particularly difficult decision-making process. The objective of any vendor selection decision-making process is to identify the best possible vendor(s), who can meet the business' needs over the long term at an acceptable cost. The

decision analysis process relies heavily on the collection and use of information about the alternatives. The purpose of this research is to determine how much impact (a) intangible assets such as a client company's with upper management decision makers' relationship with an outsourcing vendor and (b) tangible asset such as a vendor's size; IT breadth and IT project knowledge affect the client company's outsourcing decision. Based on preliminary interviews and additional literature review and analysis, the cost for a solution is paramount, as more IT solutions become commoditized. If competing solutions are very close to each other on price/capability, or if a project grows in risk, then the intangible assets are important and relevant.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #22)

Evaluation of Digestion Techniques for Metals Analysis in Tissue Samples

Brian Lenherr – Environmental Science

Faculty Mentor: Garry Farmer

Past mining activity has increased dissolved metals concentration in many Colorado waters, such as the Snake River, a tributary of Dillon Reservoir. The increased metals levels has led to a higher toxicity to aquatic invertebrates, as well as the fish, primarily trout species, that feed on these invertebrates. There are many challenges to determining the level of metals exposure in the species affected. This poster focuses on determining a reliable method that will allow us to analyze the varying species affected by metals exposure, as well as determine low levels of copper, chromium, cadmium, zinc, silver, and manganese. Three digestion methods were selected for evaluation, all of which are based on EPA approved methods. Evaluation criteria for these methods are ease of use and consistently reliable results. These methods are preparative procedures for analysis by Atomic Absorption Spectroscopy and Inductively Coupled Plasma Mass Spectroscopy. Rainbow Trout (*Oncorhynchus mykiss*), a species is prevalent in Colorado, was used in this evaluation. The trout used in this study was collected from Georgetown Reservoir and donated by generous fishermen. Initial experiments showed that the best digestion method utilized a combination of nitric and hydrochloric acid. This conclusion is based on ease of use and reproducibility of results. This method was a clear stand out and will be tested further this summer on Rainbow Trout collected from tributaries to Dillon Reservoir and possibly streams and rivers in the Leadville area. Additionally, we would like to test the method on adult Caddis flies or Midges.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #22)

From Wagner to Taft-Hartley: The Colorado Labor Peace Act of 1943 and Its Impact on National Labor Legislation

Peter Leon – History

Faculty Mentor: Ellen Slatkin

The Colorado Labor Peace Act of 1943 is a relatively obscure piece of legislation that has had a profound effect on labor relations in the United States. A detailed history of the political battles over the act's passage helps to illustrate the legislation's importance to labor relations within Colorado and offers insight into the political tactics that have been used to shift the national debate by means of gradual shifts at the state level. The passage of the National Labor Relations Act of 1935, known as the Wagner Act, marked a dramatic shift in how labor negotiations would be conducted within the United States by empowering and protecting organized labor. It also marked a huge defeat for American business interests and their representatives such as the U.S. Chamber of Commerce and the National Association of Manufacturers. From the moment the Act became law, these interests embarked upon a concerted effort to shift power back towards American business. Given the pro-labor stance of the Roosevelt

Administration and the Democratically controlled Congress, these interests shifted their efforts to the individual states. These efforts bore fruit in Colorado with the passage of the Labor Peace Act a mere 8 years after Wagner. The Act also helped set the stage for the “Right to Work” movement already taking shape in other states and the push for a revision of national labor policy which took the of the Taft-Hartley Act of 1947. The fight over the Labor Peace Act provides a blueprint for how many of the future battles would be fought.

(Oral Presentation, Session I, Room 200, 9:15 AM)

Japan's Demographic Issues

Antonio A. Luna-Galindo – Sociology

Faculty Mentor: Ting Jiang

Japan is presently experiencing a period of social and demographic changes that are having socioeconomic impacts within the nation. Some of the most severe challenges that Japan currently faces include: a rapidly aging population that will see a drastic increase of Japanese elders over 65 years old by mid-century; a low fertility rate that is predicted to continue below the total fertility rate (TFR) that is needed to healthy replenish the population; a total population that is expected to drastically decline by the middle of this century; and gender/social changes that are presently taking place within society and which are directly correlated to the previously mentioned demographic issues. Especial emphasis is put on ‘herbivore’ men — a recent social phenomenon that has young men challenging the masculine ways of Japanese society, and who are characterized by a relaxed-attitude towards work, their importance on personal grooming, avoiding confrontation, but most importantly, their lack of interest in amorous and sexual relationships. Extensive research and data was collected and analyzed from different sources including the Population Reference Bureau (PRB) and the National Institute of Population and Social Security Research (NIPSSR) in order to identify the different demographics issues affecting Japanese society and the correlations between them. The relationship between these previously mentioned issues envisage a challenging future for Japanese society, more specifically institutions like the family, economy, government and healthcare. If these demographic and social challenges are not met adequately, Japan could find itself on the brink of a severe social and economic crisis by the middle of this century.

(Oral Presentation, Session I, Room 200, 9:45 AM)

“The Thing In Itself”

Aurelio Madrid – Philosophy

Faculty Mentor: James Reid

In the late eighteenth century the German Philosopher Immanuel Kant published his Critique of Pure Reason. Today, in the 21st century, the world of philosophy continues to grapple with the many issues the book raised. One particular issue has to do with the way objects are understood, or not understood, with particular reference to the thing in itself. Kant famously claimed that one can only know the appearance of things, and that the things in themselves cannot be known apart from the thing’s appearance. Kant’s systematic magnum opus Critique of Pure Reason exemplifies his brand of enlightened transcendental idealism. A thing, an object, is cognized as appearance, while the thing in itself (of that object) remains inaccessible to human understanding and experience. This is often referred to as one of Kant’s dualisms. A thing’s appearance, with the thing in itself hanging out there, was unacceptable to Kant’s successors, a.k.a. the German Idealists, Johann Gottlieb Fichte, Friedrich Schelling, and Georg Wilhelm Friedrich Hegel, et al. All three philosophers were highly critical of Kant’s thing in itself, of the three, Hegel stands

out as the formidable critic (and fan) of whom will be focus in this analysis, since his absolute idealism sought to resolve Kant's phenomena and noumenon problem.

(Oral Presentation, Session I, Room 203, 9:30 AM)

2014 NASA's Colorado Space Grant Robot Challenge

Roman Manalastas – Electrical Engineering Technology

Coauthors: Brandon Bruetti, Chris Wells, Alex McNally, Jacob Romero

Faculty Mentor: Megan Paciaroni

Our goal was to design and build a robot that simulates an autonomous robot mission on Mars. Our design concept was to use a Rock Crawler chassis with independent suspension and the back wheels being tracks. This will allow us to better navigate through the tough terrain of the Sand Dunes. We are using only one Arduino to control our motor, sensors and servos. There will be a sweeping sonar sensor mounted on the top of the vehicle for object avoidance. We are also using a tilt compensating compass to get an accurate reading from the beacon regardless of orientation. All of our components will be mounted on top of the robot enclosed in a custom acrylic box to protect electronics from the sand. If the robot gets close to an obstacle, it stops, reverses, turns to the left and then continues on its path toward the beacon signal. Our main concern is not how fast we can complete the course, but rather making sure we don't get stuck on any obstacles.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #23)

Predictive Variables of Homelessness in Colorado

Timothy Mann – English

Coauthors: Theresa Zook, Steffaine Bookhardt, Rachel McGill, Anna Hopkins

Faculty Mentor: Bethany Fleck

Through collaborative efforts from MSU-Denver and the Governor's Office of Colorado, data was collected and analyzed to better understand the factors associated with homelessness. Results indicated that race and gender are not predictive factors of homelessness, suggesting homelessness equally impacts everyone. Additional predictive outcomes of homelessness are discussed.

(Poster Presentation, Session I (9:30– 10:30 AM), Poster #25)

Delineating Putative *Amnicola* Species Using Cytochrome C Oxidase Subunit I Data

Darcy Marceau – Biology

Faculty Mentor: Hsiu-Ping Liu

The mud amnicola snail (Amnicolidae: *Amnicola*) is a widespread genus throughout eastern America ranging from Canada as far west as Utah. Recently four populations of mud amnicola were discovered from four sites outside the currently recognized distribution range, and it is likely that these populations represent previously undescribed species. The objective of this study is to analyze sequence variation using mitochondrial genes as an aid to evaluating the taxonomy. Newly designed, tested, and optimized primers were used in conjunction with universal primers to amplify partial (658 bp) segments of the mitochondrial DNA (mtDNA) segment cytochrome c oxidase subunit I (COI) corresponding to "Folmer's

fragment". Sequence data generated from these new primers was then used in phylogenetic analysis of the specimens in order to clarify the taxonomy of these putative *Amnicola* species.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #16)

Student for Interplanetary Travel and Habitation: Mars

Taletha Maricle-Fitzpatrick – Physics

Faculty Mentors: Kamran Sahami, Jeffrey Forrest

The Students for Interplanetary Travel and Habitation (SIPTAH): Mars, project is an interdisciplinary, mock, Mars mission designed to determine the feasibility of a manned Mars mission in the 21st century. It is open to students of any major offered by the Metropolitan State University of Denver. Participants have until October 15, 2014 to conduct research within their own field as it pertains to the mission objective. Each student is challenged to choose his or her own research topic with the creative freedom to determine the end-product of his or her research such as: a paper, an experiment, a model, or a work of art. Students are encouraged to cross the disciplinary boundaries by seeking help from other participants, faculty members, and professionals who are currently working in the field. Faculty members are also encouraged to join in the effort as consultants and advisors. Students can opt to use this project as fulfillment for their Independent Study requirement or as an extracurricular activity. After all research submissions have been received, they will be compiled, reviewed, and used to determine the overall success of the entire project with publication as an ultimate goal. The SIPTAH project currently has a core group of 15 students and 5 faculty members who are working together to determine spacecraft design, propulsion and fuel usage, institutional needs, landing procedures, computer networking and communications, human factors in space travel, and unmanned operations.

(Oral Presentation, Session II, Room 205, 11:00 AM)

Cadastral Glacier Inventory Through Remote Sensing

Chelsea McCabe – Land Use

Faculty Mentor: Stella Todd

The Aconcagua River basin, in central Chile provides water resources to much of the Country's Metropolitan region. According to a recent study conducted by Antonio Bellisario and his team, an estimated 70% of glacial water resources of the region are held within rock glaciers. The last glacial inventory of the area, conducted in 2003, used 30-meter resolution imagery, and omitted rock glaciers from the study. Using 1-meter, high-resolution imagery, and including 6 debris classifications, this inventory will provide the region with a more in-depth look at their frozen water resources. The absence of mining standards, a changing climate, and no existing inventory of the area's water resources within debris filled glaciers (specifically rock glaciers) may extinguish the regions natural water resources before proper regulations may be employed. Using remote sensing techniques, this project will inventory glacial water resources in the Aconcagua River basin, in Central Chile, and measure the volumetric water resources in glaciers, including debris-covered glaciers available to the metropolitan region of Chile. The product may inform decision makers of this important finite resource, and help make sustainable decisions for the future.

(Oral Presentation, Session I, Room 205, 9:30 AM)

Using Landsat Imagery to Assess Burn Severity of the West Fork Complex Fire and Hydrologic Impact to the Rio Grande Basin

Ryan McCarley– Land Use

Faculty Mentors: Thomas Davinroy, Stella Todd

In the summer of 2013 the West Fork Complex Fire raged in southern Colorado. Burning over 109,000 acres the fire has had a significant impact on the hydrology of the area, especially the Rio Grande watershed (RWEACT 2013; Yochum and Norman 2014). Throughout the literature on hydrologic responses to fire, fire severity has been found to be the most significant variable (Moody et al. 2008). The aim of this study was to use remote sensing to estimate additional runoff that could be generated from the burned area. Because Landsat data is widely available at no cost, it is a useful tool for this analysis. There are several methods of determining burn severity, which exploit the difference in spectral reflectance between healthy vegetation and bare ground. A review of the literature in this report attempts to determine the differences between techniques. Using Landsat 7 imagery from September 2012 and 2013, the Differenced Normalized Burn Ratio (dNBR) was calculated. Adjustments were made for the Scan Line Corrector (SLC) error that occurs in Landsat images since 2003. Gaps in data caused by this error were classified by training dNBR from existing data and accounting for environmental factors such as slope, aspect, landcover and soil. Using the U.S. Corps of Engineers' HEC-GeoHMS model, data about soil, landcover and burn severity was converted into a curve number (CN) grid. This surface models runoff response from any given precipitation input. Compared to a similar study by Yochum and Norman (2014), which used ground-truthed U.S. Forest Service data, there was substantial difference. This study showed a higher burn severity and greater runoff response. This highlights the difficulty with using multispectral data to assess burn severity, which is that high severity is often overestimated.

(Oral Presentation, Session III, Room 204, 3:00 PM)

Pump Training Apparatus

Scott McDonald – Mechanical Engineering Technology

Coauthor: Tyra Carder

Faculty Mentors: Lynne Zhao-Bowden, Mingli He

The purpose of this project was to develop a working skid of an ANSI style pump utilizing acrylic plastic to have a clear view of the impeller and sealing chamber. The pump skid has been purposefully designed under what is recommended for proper running procedures to better demonstrate, visually, the damages that occur when pumps in the field are improperly handled. The demonstration would show the effects of cavitation and damage it can cause to the impeller, as well as the amount of wasted heat in the sealing chamber. Also, with a Power indicator hooked up to the pump motor, we can show how much power is wasted when the pump is run inefficiently. The demonstration will not only help raise awareness as to why pumps like this one and much larger fail, but also give a better understanding of fluid mechanics.

(Oral Presentation, Session II, Room 205, 10:30 AM)

Swisslog: Multiple Carrier Dispatch

Andrew Mejia – Mechanical Engineering Technology

Coauthors: Mason Fox, Nicole Herrmann

Faculty Mentor: Lynne Zhao-Bowden

Swisslog is a global supplier of integrated logistics solutions with a comprehensive portfolio of services. Its Automated Materials Transport Systems ensure quick, flexible and safe transportation of medication, specimen and basic supplies between the different areas within hospitals. The current Swisslog station only has the capability to load one carrier at a time for dispatch, which can lead to extended time at the station. The objective of this project is to address customer's needs by improving the standard station that allows the stations to queue multiple carriers without human intervention in order to decrease the amount of time taken to send them. The main goal of this project is not only to maintain the quality reputation of the company, but also to provide better functionality and efficiency of their product by overcoming its limitations and, consequently, offer more accessibility to users and capability to the system. By accomplishing this assignment, the new design should be feasible according to the requirements established by Swisslog. This design consists on implementing new features to existing stations by utilizing the empty space in the current system. One goal of the design was to avoid manufacturing a new station by creating a subsystem that can be added to the existing stations. This provides the possibility of upgrading all stations already in use. The design for multiple carriers includes the use of a ramp for storage along with a track-timing belt powered by an electric motor, which places the carriers into dispatch position. It utilizes other components such as photo and pressure sensors to guarantee the functionality of the system. The completed design, including selected materials for each component, was found to be relatively inexpensive and the chances of mechanical failure are minor.

(Oral Presentation, Session II, Room 205, 10:45 AM)

Preparation and the Inverse-Electron-Demand Diels-Alder of 3,6-Bispyridyl-1,2,4,5-Tetrazines

Max Minnig – Chemistry

Coauthor: Jedediah Wilson

Faculty Mentor: Susan Schelble

The 2,3, and 4 bispyridyl-1,2,4,5-tetrazines were prepared from 2,3,4 cyano pyridines using a sulfur catalyst. Inverse-Electron-Demand Diels-Alders were carried out between 3,6-bispyridyl-1,2,4,5-tetrazines and the following alkenes-cyclohexene, limonene, 2,3-dimethyl-2-butene, alpha-(+)-pinene, and 2-butene. Synthesis of Diels Alder adducts, the 3,6-bispyridyl pyrazadines and 3,6-bispyridyl-1,2-dihydro pyridazines were confirmed by GC-MS, ¹H-NMR, and ¹³C-NMR. The three and four substituted pyridyl groups on tetrazines have shown to be the most effective in yielding clean isolated product, but reaction time is longer than that of 2 substituted pyridyl tetrazine. The more substituted dienophiles that do not aromatize following cycloaddition react much slower with the tetrazines with significantly lower yield. High boiling point solvents and increased reflux time have been most effective in yielding the Diels Alder adducts of 3,6-bispyridyl-1,2,4,5-tetrazines.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #26)

“The Way to Lost” A Visual Forensic Analysis of the First 44 days of the 1937 Second Attempt by American Aviatrix Amelia Earhart and Navigator Fred Noonan to Circumnavigate the Earth

Zyola T Mix – Aviation Technology

Faculty Mentors: Jeffrey S Forrest, Jose M. Lopez

Much is known and hypothesized about the final flight in 1937 of Aviatrix Amelia Earhart and PanAm Navigator Fred Noonan in which they vanished in the South Pacific. However, little is known of their flights around the world prior to their disappearance. At the time there was little support or interest in the journey, resulting in the most detailed records of the flights, listing exact times, dates, and route changes were lost with Earhart and Noonan. It wasn't until they were lost that the story gained its historical romance. This study is an in-depth forensic inquiry and emulation of the twenty-six legs and more than thirty flights Earhart and Noonan successfully completed. Using AGI's emulation software package, Systems Toolkit (STK), each flight is reconstructed in two and three-dimensions simulating actual flight times, speed, altitude and take-off and landing procedures. Actual dates and times of flight events and radio frequencies are determined from extensive research into surviving airport logbooks and extrapolated from letters, newspaper articles, military records, weather reports and climate trends. The simulation operates in “real time” resulting in a 44-day scenario including flight and ground stays. It begins with their covert flight out of Oakland, California, includes false starts, flyovers, and the initial search by U.S. Coast Guard vessels and Fixed Base Operators throughout the Pacific. The intended purpose of this forensic emulation is to become an exhibit at Wings Over the Rockies Air and Space Museum in Denver, Colorado.

(Oral Presentation, Session I, Room 206, 9:00 AM)

Genetic Characterization of Cutthroat Trout Subspecies

Nickolas Nelson – Biology

Coauthors: Christina Hall, Loreli Bratton

Faculty Mentor: Douglas Petcoff

The Cutthroat trout, *Oncorhynchus clarki*, is a complex of sport fish that contains four infra-species and 14 sub-species. Populations of Cutthroat trout have been greatly reduced throughout the West and two sub-species are considered extinct. Decades of indiscriminate stocking, habitat alteration and over-harvesting have contributed to diminished genetic integrity as well as decreases in population size. Management agencies have increased their efforts to evaluate the genetic composition of cutthroat trout populations in order to identify populations that remain uncompromised and manage them accordingly, but additional genetic markers are needed to do so effectively. The mitochondrial genes, ND2 and CO1 are frequently used for the evaluation of trout. A growing consensus is that the ND2 gene changes rapidly. CO1 data suggest two fairly divergent lineages. Using only this data for taxonomy and subsequent management policies would be imprudent. In this study, the effort has been focused on the isolation and sequencing of the ND5 mitochondrial region, a highly conserved and an essential subunit of the respiratory NADH dehydrogenase (Complex I). Mitochondrial DNA was extracted from fresh samples obtained from a number of diverse locations in Colorado, consistent with the locations of historical samples previously collected and reported on in the current literature. Primers specific for the ND5 gene were employed to provide samples for sequencing and comparison with previously described sub-species specific SNPs obtained from ND2 and CO1 gene sequences from the same sample population. Genomic and bioinformatic studies will be employed to assess the correspondence between SNPs from the respective gene sequences in order to assess the reliability of the mitochondrial markers currently in use. The ultimate goal is to sequence and publish the entire mitochondrial region for native

cutthroat trout. The effective restoration of native populations depends entirely on the reliable and cost effective identification of the remaining indigenous populations of these popular sport fish.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #6)

A Model to Foster Myelination, *In Vitro*, of Neural Cells Differentiated from Neural Precursor Stem Cells

Nickolas Nelson – Biology

Coauthors: Laura Roon, Mish Desmarais, Christina Hall, Loreli Bratton

Faculty Mentor: Douglas Petcoff

One of the issues confronting the treatment of central nervous system (CNS) injury or disease is the inability of CNS tissue to spontaneously repair itself and generate the myelin tissue necessary to insulate nerve fibers. Most CNS disease or injury, other than those conditions that can be mitigated by surgery or chemotherapy, usually result in irreversible changes, with little or no regrowth of healthy CNS tissue. Embryonic stem cells (ESCs) offer the potential for the application of cellular therapy through the in vivo delivery of specific cells to repair and replace diseased or damaged organs or tissue. Those stem cell lineages must, as well, be accompanied by the appropriate exogenous factors required to result in the biological behavior necessary to establish normal growth and proliferation. The principle objective of this study was to design and develop protocols and culture conditions that promoted the in vitro myelination of newly matured neural cells as a model for the ultimate transplantation of differentiating precursor cells into areas of central nervous system injury or disease. This project employed feeder-free, serum-free culture environments to maintain mouse Neural Precursor Cells (mNPCs) through the supplementation of neural cell specific media. Chemical factors were applied to the mNPCs to stimulate the differentiation of the neural precursors into the three end-lineages, including neurons, oligodendrocytes, and astrocytes. At cell maturity, oligodendrocytes and astrocytes were added to the cultures containing maturing neural cells, and additional differentiation factors were added to the co-culture environment to stimulate the myelination of the neural cells by oligodendrocytes. The generation of appropriate end-lineages and myelination was verified by light microscopy and fluorescent microscopy utilizing immunocytochemical techniques. The generation of end-lineages was quantified by qPCR. With further refinement of the culture techniques and protocols employed in this study, consistently high concentrations of the appropriate cell types and generation of myelin by oligodendrocytes can be produced.

(Oral Presentation, Session III, Room 204, 3:45 PM)

Scope of Massage Training in Physical Therapy Education. A Literature Review And Meta-Analysis

Adam Norman – Human Performance and Sports

Faculty Mentor: Nancy Sayre

Current physical therapy training involves complementary alternative medicine training. What criteria is used for this training, considering evidence based models and other standards of research. How does differing standards of research from the AMA, APTA, and AMTA differ.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #17)

Rational Design of Small Molecule Inhibitors of the Myc-Max Transcription Factor Dimerization Interface

Jeremy O'Brien – Chemistry

Faculty Mentor: Andrew Bonham

Myc is a transcription factor involved in cell cycle regulation. Heightened expression of this protein can cause uncontrolled expression of key cell growth genes. This over-expression commonly results in cancer. In order for Myc's oncogenic properties to take effect, it must dimerize with the protein Max to form a complex that binds to DNA. Using ligand-protein binding analysis software, we have designed several inhibitors of this dimerization process, which we have verified *in silico*. These potential inhibitors were synthesized using standard coupling reactions, with identity and purity confirmed via GC-MS and NMR analysis. *In vitro* efficacy of these rationally designed small molecule inhibitors was tested using recombinantly expressed Myc and Max proteins, along with transcription factor beacon bio-sensors, which allow quantitative and real-time detection of protein:DNA interactions. Based on these studies, more potent and selective chemotherapeutic agents, targeted to protein dimerization interfaces in oncogenic regulators, can be designed and used.

(Oral Presentation, Session I, Room 204, 9:30 AM)

Scaffolding the Teaching of NMR Spectroscopy

Jeremy O'Brien – Chemistry

Coauthor: Joe Salazar

Faculty Mentors: Connie Gabel, Rosemarie Walker

Nuclear Magnetic Resonance (NMR) Spectroscopy is a topic in the curriculum that is difficult for students to understand and comprehend. Organic chemistry requires a high level of knowledge organization, and spectra seem to create a disconnect with previously learned material for students. Spectroscopy requires copious amounts of material that can overwhelm students with information overload. Supplemental Instruction (SI) with scaffolding has been found to help students better understand the difficult concepts of spectroscopy. SI uses techniques such as chunking and reverse engineering that allow students to comprehend NMR more effectively. These techniques focus on one of the intertwined concepts at a time. The SI leader assists students in working together to learn NMR techniques followed by diminished scaffolds from the peer leader in later sessions. Data shows that students who attend these SI sessions have increased levels of understanding NMR.

(Oral Presentation, Session III, Room 204, 3:30 PM)

Align MSU Denver First Responder UAV

Magens Orman– Aviation Technology

Coauthors: Lance Ferguson, Megan Hull, Nick Webb, Que Roberts, Mark Martinez, James Pavak

Faculty Mentors: Jeff Forrest, Brent Balazs, Jose Lopez, Ted Shin, John Wanberg

In emergency response operating environments, first-responders know a few seconds of time can mean the difference between rescue and loss of life. Rapid collection of needed information in emergency response renders efficiency and increased probability for a successful rescue. A remote controlled unmanned aircraft vehicle (UAV) can survey and provide greater situational awareness related to many emergency response situations. UAVs can fly through constricted or dangerous spaces, while providing

remotely located emergency response command centers with real-time data and information. Search and rescue teams require UAVs that are reliable, accurate, and user friendly. With multidisciplinary collaboration as a key element, we intend to conduct formative research to design and evaluate a remote controlled multi-rotor UAV. This UAV is capable of operating in field environments that are established as restricted laboratory test areas. The prototype UAV will be equipped with state-of-the-art remote sensing systems including first person viewing (FPV) technology to providing real time assessment for emergency rescue information gathering capability. The first modular sensor dedicated to the visible spectrum and the second sensor utilizing the infrared spectrum. A third, optional sensor, a multipurpose sensor prefabricated by Sensorcon for direct environmental air quality assessment. Alpha tests for UAV prototype utilizes an on-board processor which does not require the operator to be a licensed or experienced pilot. UAV prototype designs will also reflect the requirements to be field-ready within seconds of time and to fit conveniently in a backpack for transportation in the field. A trade-analysis of design elements and associated decision making will be provided as a summative evaluation of the prototype UAV.

(Oral Presentation, Session III, Room 205, 3:00 PM)

Auraria UAV Crisis Response to Flooding on Campus

Magens Orman– Aviation Technology

Coauthors: Que Roberts, Nick Webb, ChukwuEmeka Mecca Akotaobi

Faculty Mentors: Jose Lopez, Jeff Forrest

In modern crisis response scenarios police, firefighters and search and rescue crews implement cutting edge technologies such as advanced sensors on aircraft to locate survivors. Helicopters have traditionally been the most common aircraft used in these instances. They are maneuverable and can operate at low speeds to allow crews to search for people as well as for sensors to scan large areas in short periods of time. This method is expensive as it requires large quantities of fuel, specialized pilots, and coordination on the part of the pilot and support crew. Helicopters are cumbersome, requiring large amounts of space to operate making environments with close quarters such as cities or forested areas a safety risk to both pilots and passengers. Today Unmanned Aerial Vehicles (UAVs) and small Unmanned Aerial Systems (UASs) are being manufactured by big corporations as well as little startup companies nationwide. These machines are maneuverable, capable of autonomous decision making and covering large areas of land, including close quarters, in short periods of time. UAVs are cost effective, safe and user friendly. Coupled with other advanced technologies, a UAV could take the place of a helicopter over populated areas safely and effectively. This study seeks to visually demonstrate the usefulness of UAVs during a flooding crisis on the Auraria campus. Using Systems Tool Kit (STK) by software designer Analytical Graphics Inc. as well as hands on research and testing using physical UAVs, this study provides strong evidence in favor using UAVs on campus during a flooding crisis.

(Oral Presentation, Session II, Room 205, 11:15 AM)

The Benefits of 20 Second Hugs in Dementia Patients

Bonnie Orr– Nursing

Coauthors: Theresa Freund, Katarzyna Zrodzowska

Faculty Mentor: Alexis Newton

Approximately 80% of long term care residents suffer from behaviors and symptoms related to dementia. Twenty second hugs have demonstrated an increased oxytocin level in humans of all ages. It produces a calming effect that lessens anxiety and increases overall well-being. This study proposes that twenty

second hugs in female dementia patients over sixty-five years of age will decrease the adverse behaviors throughout the day. Using the Agitation Behavior Scale (ABS) anxiety and behaviors will be observed and recorded in residents with a baseline of known adverse behaviors after the twenty second hug in the morning. This study should predict cost effective easily learned and applied therapeutic interventions that will benefit this population.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #15)

Understanding the Power of Parallelism in Literature

Karen Ortiz– Modern Languages

Faculty Mentor: Maria Rey-Lopez

Parallelism has long been used as a technique in literature. It is important to understand the method and the contributions it adds to literature, as well as the effects that are realized with it –especially in modern novels. In reading a long novel, one will usually feel overwhelmed with the amount of material that is to be read. However, parallelism can add a vital flair in maintaining the reader's attention. To further this argument, Ruiz Zafón's modern novel, *La Sombra del Viento* was analyzed in an analytical sense and a conclusion was reached that avid readers and writers will benefit by understanding how this technique is helpful in literature.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #14)

The Get Out of Jail Free Card: Is Having Money Enough to Ensure Pretrial Release?

Zakery Peterson – Economics

Faculty Mentors: Rey Hernandez-Julian, Jennifer Bradford

The Get Out of Jail Free Card: Is Having Money Enough to Ensure Pretrial Release

This project is aimed at examining the impact that an individual's income has on bail outcomes such as the decision to release a defendant awaiting trial, the type of bond that is set, and the bond amount. The hypothesis which is being tested is as income is decreased the negative outcomes of bail are increased. That is to say that as income decreases the defendant is less likely to be released, the bond is less likely to be a personal recognizance bond, and the amount of the bond will increase. Additionally, the study examines the relationship between the jailed homeless population and pretrial and bail outcomes. Particularly, the study wanted to examine if homeless individuals are less likely to be released from jail and whether a homeless status is an indicator for increased pretrial misconduct. The preliminary findings have found statistically significant relationships between income and release from jail but have not found statistically significant relationships between income and the bond amount set or the type of bond set.

(Oral Presentation, Session II, Room 206, 11:30 AM)

Biodiesel Production for Aid in Campus Sustainability

Arthur Philipson– Chemistry

Coauthors: Joshua Holloway, Ngor Abiar, James Zimmerman

Faculty Mentor: Michael Jacobs

With the rise of sustainability issues surrounding petrol fuels, a shift towards alternative and clean burning fuel sources is evident. Biodiesel is one option that can help curb petroleum dependency without

the need for mechanical alteration. The trans esterification reaction of making fuel grade biodiesel provides a wealth of chemical research opportunities. Metropolitan State University (MSU) of Denver along with the University of Colorado Denver and the Community College of Denver are developing a paradigm for campus sustainability utilizing waste cooking oils on campus for the production of biodiesel. The program raises sustainability awareness and encompasses multiple departments of science such as: Chemistry, Earth and Atmospheric, Engineering and Technology, and Environmental Science. The production of biodiesel and the associated analytic processes, ensuring standardized quality fuel, include: trans esterification reactions, titration of free fatty acids in the feed stock, viscosity, soap content determination, water content testing, and instrumental analysis such as IR and GC-MS. Undergraduate students gain conceptual and practical understanding of bio-fuel standardization, analysis, applications, and usage from hands-on experience with this model. The program is also includes researching optimization methodology for the production of biofuels on a large scale, 40-gallon reaction, as compared to the methodology of bench top reactions, 500 mL reaction. The use of this study is intended to aid efforts of the sustainable campus initiative, and alternative transportation services at Auraria campus.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #18)

Sexuality, Happiness, Gender Differences, and Relationship Satisfaction

Addie Pisel– Psychology

Faculty Mentor: Chrislyn Randell

Previous studies have provided conflicting information as to the happiness and relationship satisfaction of homosexuals in comparison to heterosexuals, as well as the differences between men and women. This study investigated differences in relationship satisfaction and happiness between heterosexual and homosexual individuals as a function of gender. Participants were asked to fill out two questionnaires, the first being the Oxford Happiness Questionnaire, and the second being the Happiness and Satisfaction With Relationship Measure. A 12 question 7 point Likert scale so scores can be between 12 to 84, survey meant to measure closeness and happiness within the relationship with such questions as: "In general, how satisfied are you with your relationship" and reverse score questions such as: "How many problems are there in your relationship". Participants were instructed to answer questions on the Happiness and Satisfaction with Relationship Measure, based on a current relationship, or the most recent committed relationship if single. Approximately 30 participants were recruited from the Psychology Department participant pool, consisting of introductory psychology students Data is still being collected at this time. The 2 (Sexual Orientation) X 2 (Gender) ANOVA is expected to show homosexual women and heterosexual men are happier and more satisfied with their relationships than heterosexual women and homosexual men.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #4)

Kim Orr: Homeless with a Debilitating Disease

Philip B. Poston – Journalism/Technical Communication

Faculty Mentor: Kenn Bisio

Kim Orr has been homeless since November 2012. Kim suffers from MS as well as a traumatic brain injury, which occurred when she was 16. She became homeless after her domestic partner, Mike, abandoned her in an Aurora, CO motel during a visit to see a specialist about her MS. He left her with a \$20 bill. The day before our first meeting, Kim lost all of her bags and clothing except one small roller. She had to be taken to the hospital and left her items at the day shelter where she was when she went to the hospital. Due to the shelters policy her items were unable to be held overnight and they were thrown

out. Kim struggles doing day-to-day activities. A trip to her doctor's office for a check-up requires that she take a cab to the light rail, which she takes to the bus, which takes her to her doctor's office. The ride takes a little over an hour each way, and she has to coordinate all the times, which can sometimes be a struggle to meet as a result of her MS. Shopping for new luggage to replace that that was thrown out was a bit of a task for Kim too. She was overwhelmed by the choices offered and had trouble remembering which ones she was partial to, which she blamed on her brain injury. Kim is steadily trying to get off of the streets, but it is difficult to get public housing and is a long and arduous task that requires multiple meetings which is not always easy for her. She gets tired very easily, especially after long days, and can't get around very well. "Being homeless is a 24-hour job... I want out of this real bad." – Kim Orr

(Oral Presentation, Session II, Room 206, 11:45 AM)

Nitrogen Cycling in Green Roof Soil

Erica Prather – Biology

Faculty Mentor: Rebecca Ferrell

The Student Success Building (SSB) on the Auraria Campus in Denver, Colorado is home to a sustainable green roof, first laid down by SemperGreen, Inc. two years ago. A green roof is beneficial due to its heat mitigating effects, ability to create wildlife habitat, and pleasant appearance. No green roof in a semi-arid climate has been studied on a microbiological level; of particular interest is the nitrogen cycling in the soils of the green roof, a crucial element in the success of plant growth. Three microclimate zones were designated: one in a shaded corner, which seems to have enhanced plant growth, one near south-facing windows that reflect additional light, and a zone in the middle of the roof that has typical plant cover; a graveled area on the roof provides an abiotic control, and landscaping beds near the SSB provide ground level controls. A scheme of perpendicular transects was used for sampling, with eight soil samples taken from each zone. Soil DNA was extracted using a PowerSoil kit (MoBio), with the DNA yields from ground level controls and green roof zones averaging 8-12 fold lower than compost controls. Soils were analyzed for organic matter content and nitrification potential, and quantitative PCR is underway to test for levels of several genes involved in the nitrogen cycle, including *amoA* (ammonia oxidation), *nxrA* (nitrite oxidation), *nifH* (nitrogen fixation), *nirK* (nitric oxide production), *norB* and *norS* (nitrous oxide production), as well as 16S rDNA genes of Bacteria and Archaea.

(Oral Presentation, Session III, Room 204, 3:15 PM)

Didacticism, Subversion, and Ideology in Children's Literature

Derek Price – English

Faculty Mentors: Craig Svonkin, David Boyd

Perry Nodelman, a highly accredited and acclaimed children's literature academic, claims that ideology cannot be separated from how a society views children and their literature. He theorizes that what we see as "common sense" become "obviousnesses"; our ideology becomes so ingrained within societal consciousness that we are no longer able to see our beliefs as ideological. Our judgments about children become skewed and ordinary, because the hegemonic ideals normalize our culturalized and often ethnocentric value judgements, and we think that it is obvious what children are, how they think and work, and what kind of literature they should be reading. Alison Lurie, another well-known children's literature theorist, writes that there are two kinds of literature for children based on opposing ideological claims: one is didactic literature, or text that aims to teach some system of values to children, whether it be educational, moral, or ethical, as long as the information and claims being displayed follow with the societally-established system of values. The other opposing type of literature is what she calls sacred texts, or subversive media. These tend to promote rebellion, creativity, and unorthodoxy, promulgating

values that are in contrast to culturally-normative didactic works. I will attempt to argue how conservatively didactic children's literature undermines the value of the subversive, art, and aesthetic value in general and coerces the child into suppressing their inner creativity and critical independent thinking skills. Nodelman states that since we idealize the child, we create the idealized child in return, generating self suppression by imposing our ideals on children. I will show how this battle for childhood identity is apparent in the ideological claims behind the author's work by giving specific examples of both kinds of literature, from Maria Edgeworth's *The Purple Pot* and her didactic demeaning of aesthetics to Dr. Seuss' subversive releasing of the ID in *The Cat in the Hat* and other works, rigorously examining the author's underlying idyllic preconceptions of childhood.

(Oral Presentation, Session III, Room 200, 4:00 PM)

The Influence of Family Functioning and Familial Social Support in Adolescent Psychological Well-Being

Tara Printy – Speech Communications

Faculty Mentor: Christine Cooper

Research has indicated that adolescents shape a sense of self and thus maintain psychological well-being primarily through family communication and interaction. If an adolescent's well-being is not maintained, cognitive impairments and problem behaviors may develop. The purpose of this research is to address how family functioning (i.e., power structures, rules and boundaries of cohesion and autonomy) and familial social support contribute to an adolescent's psychological well-being. This study will also examine the extent to which identity formation mediates the relationship between family functioning and social support, and adolescent psychological well-being. These variables will be examined through a symbolic interactionist approach, utilizing the lens of structuration theory. To address a lack of quantitative focus in the literature, data will be gathered utilizing reliable, existing measures for family functioning, perceived familial social support, and adolescent psychological well-being. Interviews will be conducted to collect qualitative data regarding identity formation. A correlation test will be run on all variables. Ethnicity, economic status, gender, and family structure will also be addressed and entered into a regression analysis along with the key variables to determine the level of contribution to psychological well-being. This study hypothesizes that a family's ability to communicate support and function as a healthy system will significantly affect an adolescent's psychological well-being. The implications of this study could influence the way that therapists treat a child's symptomatology by addressing the family system rather than focusing on the child's symptoms alone. In addition, this study could support the development of effective parenting strategies.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #26)

Unequal Opportunity: A Look at Student Homelessness and Academic Achievement

Jennifer Raby – Sociology

Faculty Mentor: Amy Eckert

Education was once considered to be the great equalizer, though increasing income inequality and academic achievement gaps show that this is no longer true. While students with lower socioeconomic status traditionally see less potential for academic achievement than their wealthier peers, a subset of impoverished students are at even higher risk for academic failure- homeless students, or those with high residential mobility. Sean Reardon points out that "we tend to think of the relationship between socioeconomic status and children's academic achievement as a sociological necessity, rather than as the

product of a set of social conditions, policy choices, and educational practices (Reardon 2011)”. The purpose of this research is to look at the relationship between socioeconomic status and academic achievement as it relates to student homelessness and examine the resources (or lack thereof) in place to help these at-risk students succeed.

(Oral Presentation, Session II, Room 206, 10:45 AM)

Using NDI Sequences to Determine Species Status of *Pyrgulopsis gilae*

Victoria J. Ratcliffe – Biology

Faculty Mentor: Hsiu-Ping Liu

Pyrgulopsis gilae is a small aquatic snail species, with shells that only reach 3-4 mm in height (Hershler 1987). This species can be found along various forks of the upper Gila River in New Mexico. *P. gilae* is recognized by the State of New Mexico as a threatened species (NMDGF 2010), and the United States Forest Service recognized *P. gilae* as a sensitive species (USFS 2007). A previous study (Liu et al. 2013) utilized two mitochondrial genes, cytochrome c oxidase subunit I gene (COI) and NADH dehydrogenase subunit I gene (NDI), to delineate population structures within the *Pyrgulopsis gilae* species. However, despite redesigning multiple primers, and experimenting with various polymerase chain reaction (PCR) conditions two of the fourteen sample populations, G8 and G11, could not be successfully amplified. Even without these two populations, Liu et al. (2013) was able to delineate three previously unrecognized distinct lineages within *Pyrgulopsis gilae* based on the COI gene. The objective of this study is to design new NDI primers, specifically for G8 and G11, to provide additional NDI sequential data to verify the delineation of genetic lineages within *P. gilae*. The results of the project will be used to verify COI gene data, as well as be used to help determine the species status of *Pyrgulopsis gilae* and guide current management efforts.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #16)

Reduced Scale Enclosure Reproducibility Testing

Kayla Rauh – Criminal Justice

Coauthors: Timothy Stilen, Richard Bassett, Tony Roybal, Mason Etter

Faculty Mentors: Kevin Hammon, Mark Campbell

Reduced Scale Enclosure Reproducibility testing, in of itself, is a tool to provide/compliment data which is collected at a fire scene, or used to validate or test hypotheses. Building and burning a reduced scale enclosure provides insight into numerous components: fire effects, dynamics, and patterns within this enclosure. By gaining greater insight into the effects, dynamics, and patterns of fires through the building and burning of reduced scale enclosures not only adds to prior knowledge conducted, but it gives individuals in this field another tool to understand a fire(s) where only the destruction may remain. A fire investigator could utilize reduced scale enclosures to test a hypothesis on what happened in a certain fire, develop new skills, and save valuable time and money. In order to conduct this research our team: built reduced scale enclosures based on specific scaling laws, inserted room contents (carpet, carpet padding, couch, large chair, small chair, coffee table, and ignition fuel package), burned the RSE's, and examined and documented various aspects of the fire. All of which, are imperative to gaining insight into these specific fires, or fires in general. Through the utilization of reduced scale enclosures the possibilities are in many ways endless, they give anyone the ability to come up with a hypothesis and test this out in a time and money efficient manner; essential to the progression of our knowledge as a field, and as a society, into the many dynamics of fires.

(Oral Presentation, Session III, Room 200, 3:30 PM)

Service Learning Project: Fire Prevention

Kayla Rauh – Criminal Justice

Coauthors: Timothy Stilen, Richard Bassett, Tony Roybal, Mason Etter

Faculty Mentor: Mike Stanley

Prevention is an act that many forget to shed light on, the very notion of preventing something means that it never comes to fruition. Our service learning project encompassed the very notion of prevention and how imperative it is to include in educating the public. We took what was being taught in the class and applied it to a community, a community which would otherwise have limited availability to tools and educational materials which are pivotal in preventing fires. Through the help of numerous institutions, and some friendly knocking on doors, we were able to find households interested in: CO2 monitors, fire alarms, and fire extinguishers being placed in their homes. Many of us take advantage of tools such as these, which are meant for one key purpose: to save lives. Through the education of the public, especially demographics where the majority of the individuals speak English as their second language, if at all, or have different cultural backgrounds, we can help: prevent fires, make neighborhoods safer, educate families on habits which will decrease their chances of starting a fire, reduce the costs, save lives, and create a bond with the communities where many of us live, or work in. Prevention is imperative and there is room for projects such as this to be implemented in many ways and throughout many areas of our society.

(Oral Presentation, Session II, Room 200, 10:45 AM)

Isotopic Studies of Uranium in Soils Near a Former Cold War-Era Nuclear Fuel Fabrication Facility

Daniella Reyes – Chemistry

Coauthor: Gilberto Garcia

Faculty Mentor: Michael Ketterer

The former Texas Instruments facility is a former nuclear fuel fabrication facility located in Attleboro, MA, that was operational during 1952-1981. As a result of these activities, the site itself became contaminated with both enriched and depleted uranium. No similar data exist about the offsite environment near the former facility. We have collaborated with community member John Sullivan to address this question, and have analyzed U isotope signatures in soil cores collected from the proximity. The cores were sectioned into depth intervals, dried, ground, and sub-samples were leached with 2 M nitric acid to dissolve the anthropogenic U as well as a portion of the naturally occurring U. Solid-phase uranium-selective extraction resins (UTEVA and TRU, www.eichrom.com) were used to prepare purified U fractions that were analyzed by inductively coupled plasma mass spectrometry. The results consist of the isotope ratios $^{234}\text{U}/^{238}\text{U}$, $^{235}\text{U}/^{238}\text{U}$ and $^{236}\text{U}/^{238}\text{U}$; signatures of soils possibly containing enriched or depleted U can be compared to the naturally occurring U ratios of 0.000055, 0.00725, and $< 10^{-6}$ for these three ratios, respectively. Controls of both naturally occurring U as well as soils from known enriched- or depleted U sites were prepared and analyzed alongside the samples. Locations were found near the former Attleboro facility where contamination with either enriched U ($^{235}\text{U}/^{238}\text{U} > 0.00725$) or depleted U ($^{235}\text{U}/^{238}\text{U} < 0.00725$) was evident. Common-denominator mixing plots of $^{234}\text{U}/^{238}\text{U}$ or $^{236}\text{U}/^{238}\text{U}$ vs. $^{235}\text{U}/^{238}\text{U}$ are linear and indicate that the U in the environment originates from mixtures of naturally occurring and contaminant U.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #28)

Investigating the Efficiency of Cell Lysis Process Using Baker's Yeast Cells Via the Chemical and Sonication Procedures

Yerelsy Reyna – Biology

Faculty Mentor: Andrew Bonham

Cell lysis, the process of disrupting a cell's structure to allow the release of its contents into solution, is an essential technique in biochemistry. However, students in biochemistry lab courses often have poor technique, which can result in incomplete lysis. A quick and easy method to accurately gauge the extent of cell lysis in a cell sample would be a valuable inclusion in the undergraduate biochemistry laboratory curriculum. To address this need, we are investigating spectrophotometric and fluorometric assays for cell lysis in baker's yeast, *Saccharomyces cerevisiae*. Baker yeast from a teaching point it is efficient on time and supplies since it's relatively inexpensive and can be preserved for long periods of time. Baker yeast cells contain Cytochrome C and are a highly desirable protein it contains heme group. The experiment allows students to follow the protein through each step of purification, which leads to the experiment introducing the students to techniques for cell lysis. This will result in a rapid diagnostic assay for the effectiveness of common lysis procedures such as chemical and osmotic shock, sonication, and enzymatic degradation.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #20)

Ligand Evolution Selection Techniques to Generate Sensitive Aptamers Against Botulinum Neurotoxin

Jonathan Richards – Chemistry

Faculty Mentor: Andrew Bonham

Botulinum neurotoxin serotype A (BoNT/A) is a dangerous substance produced by the anaerobic bacteria *Clostridium botulinum*, which causes human botulism. Common infection sources include IV contamination, food sources and soil. The complexity of food and blood samples where BoNT/A contamination is suspected makes detection difficult compared to purified laboratory samples. Standard detection methods for botulinum neurotoxins require at least a day for results and have up to a ~30% failure rate. 1,2,3 These lengthy diagnostics mean that doctor examination is often the primary means of diagnosis. 4 The creation of sensitive, real-time DNA aptamer-based electrochemical biosensors to detect BoNT/A could significantly help alleviate these challenges in diagnosis and safety. Such BoNT/A biosensors could be used for detection of botulinum toxin in presumptively infected individuals and in food production facilities, leading to rapid diagnosis of botulism and better detection of BoNT/A contaminated products. In order to facilitate the creation of these biosensors, we have used a selection process called SELEX (Systematic Evolution of Ligands by Exponential Enrichment) to discover a novel DNA-based aptamer that will bind to an atoxic derivative of BoNT/A. 5 Aptamers are synthetic oligonucleic acids that bind to a specific protein target, and current efforts have yielded a pool of potentially sensitive aptamers. Next generation DNA sequencing, sequence alignment studies, and magnetic bead pulldown assays will be used to identify the best biosensor candidate. Future efforts will incorporate these BoNT/A aptamers into the existing E-DNA electrochemical biosensor platform.

(Oral Presentation, Session I, Room 204, 9:15 AM)

A Model for the Maintenance, Differentiation, and Characterization of Embryonic Stem Cells into Neural End-Lineages

Laura Roon – Biology

Coauthors: Mish Desmarais, Christina Hall, Loreli Bratton, Nickolas Nelson

Faculty Mentor: Douglas Petcoff

Regenerative and replacement therapy for diseases and injuries to the Central Nervous System (CNS) utilizing patient derived stem cells has great clinical potential. The success of this therapy hinges on the ability to culture and grow viable, discrete populations of these cells to provide available donor cell sources. Efficient and selective methods must be developed to facilitate the maintenance and passage of Embryonic Stem Cells (ESCs) and subsequently, Neural Precursor Cells (NPCs) by targeting specific signaling pathways and/or proteins with the appropriate growth factors, while maintaining a homeostatic culture environment. These protocols and techniques could be further developed as conventional therapeutics to stimulate transplanted cells to repair and regenerate diseased and damaged tissue in vivo. The objective of this study has been to develop and refine the culture conditions required to promote the growth of the three end-lineages of NPCs, which can then be used to populate experimental culture environments mimicking the in vivo metabolic conditions of mature CNS tissue. Using feeder-free, serum-free culture environments, Murine (mouse) Embryonic Stem Cells (mESCs) were cultured, passaged (up to 10 cycles), and cryopreserved for further experimentation. Those mESCs were then further cultured and differentiated into Neural Precursor Cells (NPCs) utilizing various exogenous growth factors. Several culture media formulations were tested and employed to subsequently differentiate the NPCs into their respective end-lineages, including neurons, astrocytes, and oligodendrocytes. Light microscopy and immunocytochemistry were employed to qualitatively characterize those end-lineages. qPCR was then used to quantify the results of end-lineage differentiation. Culture conditions and growth factors will continue to be modified in order to improve the in vitro conditions necessary to generate the distinct populations and volumes of cell types required for the successful regeneration and replacement therapy of CNS tissue.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #7)

Questioning Techniques to Assess Knowledge Level of Atomic Structure for General Chemistry Students

Laura Roon – Biology

Coauthors: Jonathan Richards, Melanie Flores

Faculty Mentor: Connie Gabel

Supplemental Instruction (SI) is a peer-led program that utilizes structured questioning techniques to enable students to better understand challenging concepts, such as atomic structure. At the beginning of the semester, the SI Leader administers a pretest designed to assess the extent of students' knowledge. The SI Leader then employs exploratory questioning techniques previously shown to be effective in ascertaining comprehension and identifying gaps in knowledge. As a result, students with a deficient grasp of atomic structure have their problem areas addressed and remedied. This presentation focuses on the structure of the open-ended questions and their accompanying techniques used to analyze the students' conceptual problems and close the revealed knowledge gaps. At the end of the semester, the SI Leader administers a posttest to gauge the students' advancement in comprehension as a result of this process.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #27)

Identifying Designer Drugs Using Gas Chromatography Mass Spectrum Ion Trap

Joseph Salazar – Chemistry

Faculty Mentor: Russell Barrows

Designer drugs are chemically synthesized products with similar physiological and psychotropic effects as existing illegal narcotics; however, these designer drugs have different chemical structures that have created a large challenge for Forensic Labs in recognizing these substances as illegal narcotics. This experiment will use the Gas Chromatography Mass Spectrum Ion Trap detector to do a mass spectrometry - mass spectrometry analysis of the John W. Huffman (JWH) synthetic cannabinoids to develop a method of detecting the JWH synthetic cannabinoids. Initially using an indole parent molecule as the baseline for the mass spectrometry analysis, the study will proceed with more complicated JWH molecules to eventually identify the pattern of these compounds. The synthesis of some JWH molecules will be necessary for this experiment. The goal is to develop a pattern to match all JWH molecule variations to be used in the detection of any JWH indole cannabinoid as a psycho-active substance.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #19)

Phosphorus - 31 NMR and Metal Phosphite Complex Synthesis

Tonya Santaus – Chemistry

Faculty Mentor: Eric S. Ball

Nuclear Magnetic Resonance Spectroscopy is a valuable tool for elucidating chemical structure. Phosphorus – 31 NMR is being utilized to examine chemical shifts resulting from different ligands. Syntheses of iron and molybdenum coordination compounds containing phosphorus ligands will be done utilizing Schlenk line techniques. Spectroscopic instrumentation will be used to validate the structures. Along with the shifts, the geometric configuration, such as tetrahedral and octahedral complexes, will be considered. The purpose is to gain a better understanding of the effect that different ligands have on the electronic and structural environment of the metal, utilizing a 300 MHz Nuclear Magnetic Resonance instrument.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #20)

Swisslog High-Capacity Receive Station

Mitchel Schroeder– Mechanical Engineering Technology

Coauthors: Guy Zerfoss, James Anderson

Faculty Mentor: Lynne Zhao-Bowden

Swisslog is a global supplier of integrated logistics solutions with a comprehensive portfolio of services. Its Automated Materials Transport Systems ensure quick, flexible and safe transportation of medication, specimen and basic supplies between the different areas within hospitals. The current Swisslog station used in hospitals allows 3-4 carriers before causing an overload sensor to set, depending on how carriers land and orient in the bin. An overload condition prohibits additional carriers from being delivered to this station. The objective of this project is to design a High Receive Capacity Station for Swisslog, which will provide more elegant ways of receiving carriers and organizing them in the bin or receive area that better utilizes the space and allows for ergonomic retrieving of the carriers. In this project, a new racking system is developed which is capable of housing twelve carriers and can be easily installed into the existing shell with minimal modifications. Upon arrival of the station, all carriers will be re-oriented properly into the racking system. The new design also provides increased ease of physical use as well as

aesthetic enhancements that intuitively direct the users' actions. Design simplicity and low cost are also considered in the design while achieving the increased capacity. With the help of our Swisslog mentor and faculty advisors this project was designed and constructed. Their assistance enabled us to purchase material, provided adequate work space to store and fabricate the project, and assisted in manufacturing methods. From this an affordable working prototype was created and tested.

(Oral Presentation, Session III, Room 205, 3:15 PM)

The El Reno Tornado

Andrew Schwartz – Meteorology

Coauthor: Reid Doyle

Faculty Mentor: Sam Ng

The May 31st, 2013 case of the tornadic supercell in El Reno, Oklahoma illustrates the uniqueness of the storm, as well as the creation of two debates in the meteorological community that arose from consequences of the event. One debate is that of the classification of tornadoes which is being re-examined due to the development of better in-situ storm instrumentation systems. The larger debate that has taken place as a result of the 8 deaths that of storm chasers both professional and amateur, and 151 injuries to that of other chasers and the surrounding public. The deaths as well as several incidents during the storm have been used to illustrate an opinion that limits should be imposed on who can chase storms, for what purposes and what their qualifications need to be. The case study will focus on research into what made the storm unusually strong, the series of events as the storm unfolded, and the unfavorable consequences that the storm strength had on inexperienced and experienced storm chasers alike. Weather model run data will be reanalyzed as well as in-situ data collected by mobile instrument deployment such as Doppler on Wheel trucks and mobile weather data from Kestrel observations. This presentation will also dive into the reasons of the drastic increase in the number of amateur chasers that had surrounded the storms, and compounded the problems found with the already problematic road system in the area. It will address solutions to the problem of storm chaser expansion and overcrowding by discussing ideas such as licensing and regulation by law enforcement.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #11)

Kombucha Characterization and SEM Evaluation

Sherice Shiner – Biology

Faculty Mentor: Joanne Odden

Kombucha is an ancient fermented drink made from green or black tea, and sugar. It is touted as a beneficial drink with many health enhancing effects. A kombucha SCOBY (symbiotic colony of bacteria and yeast) to date, has still been poorly characterized in regards to the nature of the specific bacteria and yeasts present in commercially available kombucha teas and home brew SCOBYs available for purchase via the internet. In this study, two kombucha SCOBYs were compared and characterized, screened for pathogenic microbes, and investigated with light microscopy as well as with SEM. Target microbes include lactobacilli, acetobacter, and yeast both of *Saccharomyces* and *Brettanomyces*. Techniques involved were SCOBY culture and propagation, various plate medias that detect specific bacteria, as well visual identification of yeasts and gram positive and negative bacteria. These techniques will help illuminate the complex composition of the microbial colonies present in each of the individual Kombucha SCOBYs.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #21)

Preferred Listening Levels on the Auraria Campus

Jolene Sletten – Speech Language & Hearing Sciences

Coauthors: Justin Keisel, Kamilah Jones, Melissa Kurrle

Faculty Mentor: Jessica Rossi-Katz

Permanent hearing loss can result from excessive sound exposure during recreational activities. Research shows that modern personal listening devices (PLDs) are capable of producing output levels that, when listened to for extended periods of time, could increase one's susceptibility to acquiring noise-induced hearing loss (Keith, Michaud, & Chiu, 2008; Keppler et al., 2010). The goal of our study was to measure the preferred levels at which individuals on the Auraria campus listen to their PLDs. Levels were recorded using a mannequin that housed a specialized sound meter. In addition to output level, participants provided demographic information including age, gender, ethnicity, and time spent listening to their PLD. Preliminary results suggest that, on average, participants listen at safe listening levels/durations. However, there are noteworthy differences across individual participants that we explore when considering demographic characteristics. The overall goal of this study was to provide educational resources on prevention of noise-induced hearing loss and collect data that can be used for a genesis of future hearing-loss prevention program for college students.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #27)

Using SAP Dashboard Interfacing and Computation to Simplify the Needs of Enterprise Energy Producers

Zachary Smidt – Computer Information Systems

Coauthors: Travis Porter, Mika Galloway, Heather Kenville, Katherine Lundblad, Michael Ignaczak

Faculty Mentor: Biswadip Ghosh

In an effort to help managers of an Enterprise Canadian Power Company better understand, review and control operations of their facilities our team created business intelligence (BI) dashboard to allow management to gain better insight into the repair and contract status associated with the production side of their facilities. Our goal is to extract a variety of information from unstructured data and present relevant repair and contract data for each respective facility in a clear and concise fashion, with the ability to list information regional geography and site location while also being able to drill down to gain further information on the status of each repair at that facility and the status of current contracts at that facility. Currently this company stores its data within massive, unstructured spreadsheets, making it exceedingly difficult for managers to discern what is valuable. We have created a dashboard using SAP that successfully parses these spreadsheets to turn a series of hundred thousand line spreadsheets into knowledge that managers can act upon, simplifying the contract and repair process for this company significantly. Our dashboard will help managers identify the sources of recurring problems and more accurately discover strengths, weaknesses, problems and opportunities involving plant repair procedures. The dashboard also covers construction of generation plants and substations, with information regarding cost, overhead investment, creation, and completion date presented. To create this, we utilized the Rapid Application Development method. Working together with industry professionals we were able to develop a functional prototype of what we expect this dashboard to do on a small scale that should translate directly into an associated energy field to streamline existing processes to assist with better decision making.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #23)

Synoptic Climatology of Heavy Snow Events in Colorado's Mountain Ranges and the Resulting Effects on Avalanche Potential

Alan Smith– Meteorology

Faculty Mentor: Richard Wagner

Conditions favorable for slab avalanche development are influenced by a complex interaction between the pre-existing snowpack and new heavy snow events. My study identifies the synoptic meteorological conditions favorable for heavy snow events at 12 locations across Colorado, and examines both the occurrences of wind-loading with these events as well as the stability of the pre-existing snowpack prior to these events. I collected temperature, snow depth, and snow water equivalent data from 12 SNOTEL locations representing common winter backcountry recreation areas across Colorado's major mountain ranges. For each location, heavy snow loading events during the months of November through April from 2004 to 2014 are defined as those in which new snow water equivalent accumulation exceeds 2.5 cm in a 48-hour period. For particularly snowy locations, the snow water equivalent threshold is raised to either 3.0 cm or to 3.8 cm to better identify heavy snow events relative to that specific location. Radiosonde data from Grand Junction is then used to identify the dominant 700 mb wind direction during each heavy snow event. For upslope storms along the eastern locations, radiosonde data from Denver is used instead. I then identify the most favorable 700 mb wind directions, which correspond approximately to ridge top level, for heavy snow events at each location. Next, I identify mid-level atmospheric temperature, atmospheric moisture, and upper-level winds associated with heavy snow events for each dominant wind direction. Heavy snow events alone are one of the primary drivers of avalanche potential, but my study also looks at wind loading potential for each event and persistent weak layer potential in the pre-existing snowpack, both of which lead to elevated avalanche potential. For wind loading events, 700 mb wind speeds in excess of 20 knots and 30 knots are identified, while for persistent weak layer potential, 30-day snowpack temperature gradients in excess of 10 degC/m and 5 degC/m are identified.

(Oral Presentation, Session I, Room 205, 9:00 AM)

Microbial Community Profile of the Sub-alpine Geneva Creek Iron Fen

Joshua Smith– Biology

Faculty Mentor: Sheryl Zajdowicz

Iron fens are a unique geological feature found predominantly in the sub-alpine environment of Colorado. Iron fens are formed when ground water seepage occurs over an area of high iron concentration, typically in the form of iron pyrite. Iron fens are acidic and exhibit high amounts of dissolved metals, providing a distinctive ecological niche for microbial communities. Limited information is available regarding the microbial community of these fens; however, we hypothesize that the organisms found in this niche are similar to those found in acid mine drainage. The purpose of this study is to determine the microbial diversity of soil samples collected from near and within the Geneva Creek Iron Fen. The Geneva Creek Iron Fen was chosen due to its proximity to the Denver Metro Area, its relatively large size, and relative lack of disturbance from a legacy of mining. Soil samples from 7 sites from across the 102 acres basin were collected in triplicate, for a total of 21 samples. Microbial DNA was isolated from these samples using a standard soil DNA isolation kit and rRNA DNA was amplified using universal bacterial 16s rRNA primers. The subsequent PCR amplicons will be cloned into a TOPO TA vector to generate a 16s rRNA library representative for each sample. Clones from these libraries will be sequenced to preliminarily determine the metagenomic profile across the iron fen region. Analysis of clone libraries from samples samples will provide a representative profile of the complex microbial community found within the iron fen.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #10)

Electrochemical Biosensors - Detection of Cell Growth Transcription Factor c-myc

Joshua Sowick – Chemistry

Faculty Mentor: Andrew Bonham

Transcription factors control the expression of DNA by binding to specific sequences; they are an essential part of all living organisms. This project is concerned with the development, optimization, and evaluation of sensitive, electrochemical biosensors to detect the presence and concentration of the transcription factor c-myc. C-myc plays a key role in regulating most aspects of cellular function, including replication, growth, metabolism, differentiation and apoptosis. Our electrochemical biosensors work by measuring the current generated on an electrode surface upon the binding of C-myc to its DNA binding sequence, which our sensor is designed to imitate. Electrochemical DNA sensors have the potential to serve as affordable, quantitative, and point-of-care tools for clinical diagnosis and academic research, and have been demonstrated to function in crude samples such as whole blood and dirt.

(Oral Presentation, Session II, Room 204, 11:30 AM)

Correlation of Dissolved Trace Metals and Black Fly Larvae Toxicity in a Colorado Mountain Stream

Morgan Spedale – Chemistry

Faculty Mentor: Garry Farmer

Many bodies of water in Colorado are impacted by mine drainage resulting in elevated levels of dissolved metals; this poses a problem because the metals are in a bioavailable form resulting in toxicity to aquatic life. The first phase of this ongoing project conducted last year detected elevated levels of dissolved zinc and manganese in Peru Creek near Dillon, Colorado. This was accomplished using dialysis membrane samplers that were left to equilibrate with the water then collected and analyzed using Atomic Absorption Spectroscopy. The second phase of this project expanded sampling into the receiving river of Peru Creek, the Snake River. Preliminary toxicity testing was conducted using black fly larvae in varying concentrations of water collected from the Snake River at the confluence with Dillon Reservoir. The results of the toxicity tests showed no mortality at high levels of dilution, but did show inhibition of metamorphosis. The water quality results for this sample suggest manganese is responsible for the observed toxicity. In addition, low levels of copper and chromium were identified by inductively coupled plasma mass spectrometry, and may also contribute to toxicity. Additional metal concentrations will be analyzed using ICP-MS in order to better characterize low metal concentrations such as cadmium and lead. Also, additional toxicity tests using manganese, copper, and chromium in combination as reference toxicants will be conducted. Furthermore, a preliminary in situ toxicity sampler using fly larvae has been developed, and will be tested in the Snake River and the Blue River; both rivers feed into Dillon reservoir.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #11)

Student Attitudes About Diversity and Campus Climate, a Preliminary Analysis

Ashley Stamps – Psychology

Faculty Mentor: Bethany Fleck

The purpose of this study was to assess student attitudes and perceptions of campus climate as well as map attitudes onto the Transtheoretical Model of Behavior Change. Three hundred and thirty six students participated in an online survey. Data indicates that participants are preparing to change their behavior towards diversity. Students overall attitudes toward diversity and campus climate were positive overall and positively correlated between measures.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #18)

Nest Abundance in Urban vs. Natural Riparian Ecosystems

Andrea Stutesman – Biology

Coauthor: Kendra Eucker

Faculty Mentor: Jennifer Gagliardi-Seeley

Availability of resources strongly influences the location that many mammal and avian species occupy. Human interaction and human dependence is likely to aid mammals and birds in obtaining resources to increase survival, seen in many cases around the world. This study aims to examine the abundance of nests in urban and natural riparian ecosystems and determine if there is a significant difference between the two. We surveyed two separate urban locations and two separate natural locations, located near Boulder, Colorado. The results obtained indicated that there was a significantly greater amount of nests in the urban locations compared to the natural ones. This data suggests that there may be a dependence on human-provided food sources and the relationship between avian and mammal species (ones that build nests) should be further examined.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #22)

Visualizing the Spatial Extent of Avalanche Problems in Popular Backcountry Recreation Areas

Ryan Teter – Land Use

Faculty Mentors: Richard Wagner, Claire Hay

With the proliferation of Geographic Information Systems (GIS) and space-borne remote sensing systems avalanche mapping and forecasting has undergone many changes. However, the application of some of the more advanced components of these systems has been limited to date. Studies using GIS to forecast avalanches have met with only limited success. What has not been thoroughly explored is the visualization of avalanche problems on a given day for use in conjunction with daily avalanche forecasts. This visualization could allow users to better understand the spatial extent of a given avalanche problem and help in the decision making process. United States Geological Service (USGS) 7.5 Minute Quadrangles, with hill-shades derived from Digital Elevation Models (DEMs) form the base map of a given area. Information is derived from DEMs concerning slope, solar radiation and the curvature of the terrain in the area. Weather data, such as wind and precipitation, is also considered. Snow telemetry (SNOTEL) sites provide relevant data, so only areas adjacent to SNOTEL sites may be used. This study uses two popular backcountry ski areas: Berthoud Pass and Bear Lake (Rocky Mountain National Park). The terrain and weather factors are converted to numerical values and computed to create a series of

raster surfaces. These raster surfaces are then displayed with the base map to visual the spatial extent of avalanche problems in a given area.

(Oral Presentation, Session I, Room 205, 9:15 AM)

Delineating New Species of the North American *Assiminea infima*

Jordan Thompson– Biology

Faculty Mentors: Hsiu-Ping Liu

The North American *Assiminea infima* is endangered species of springsnail located in the Death Valley of the lower Colorado River. The goal of this project is to evaluate the species status of assimineid population in DVLCR. Twenty-three total snails were collected from the Death Valley of the lower Colorado River region. The three sites where each samples were collected from were Saratogo Spring, Blue Point Spring and Kings Pool in the Death Valley. DNA was extracted from each individual snail using the CTAB method. Two mitochondrial genes (16S ribosomal RN and cytochrome c oxidase subunit I) were sequenced. The molecular data suggest that Blue Point Spring assimineid populations should be described as a new species.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #17)

Wind Currents During the Seasons Along the Front Range of Colorado

Ginny Thompson – Environmental Science

Faculty Mentor: Barbara Echohawk

Multiple "rose diagrams" representing the frequency for wind currents within the seasonal changes throughout the Front Range of Colorado. Data will be gathered ranging with in 30 degree bins giving twelve bins in total for 360 degrees. A " rose diagram is a circular form for a histogram. This method helps provide a view of how wind speed and direction are typically distributed at a particular location. A logical way for gathering data was to be able to obtain enough marks within a certain period of time. This is why the change of seasons and using a certain time everyday within each week of each month. To be able to calculate a controlled amount of time, I am going to use the seasonal time frame based on the Spring and Fall Equinox and the Summer and Winter Solstice. For each day I am choosing anywhere from 3pm to 6pm, due to experience of living in Colorado, the wind usually picks up around 3pm in the afternoon and dies down around 6pm in the evening. In completion the "rose diagram" should be able to provide enough data to decide on which area of the Front Range has the longest time from for windy conditions and possibly which direction it mainly resides.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #12)

Effects of Temperature on Reproductive Success of *Blaptica dubia*

Kaylee Thorson – Biology

Coauthor: Maria Lerma

Faculty Mentor: Jennifer Gagliardi-Seeley

A variety of interacting factors, including age, mating status, food availability, overall fitness, and environmental conditions, are known to have an impact on reproductive success and growth rates in *Blaptica dubia* and similar cockroach species. Population size increase, offspring viability, and colony maintenance depend on these conditions. As all insects, *B. dubia* are ectothermic and are directly

dependent on external temperatures to maintain optimal conditions for growth. Heat alone is the paramount factor impacting growth rate and egg development when a food source is unlimited. The focus of this study was to analyze the temperature effect on reproductive success between two colonies of *B. dubia*. All other conditions such as diet/food availability, lighting, housing, and humidity were identical to one another; one tank was kept roughly five degrees Celsius warmer. Data was collected over a ten week period where reproductive success was measured as an increase in population. In agreement with previous research, we found a significant difference between colony population numbers in the two temperature conditions up through week 8; where those kept at higher temperatures had more offspring.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #23)

Habitat Partitioning in Colorado Native Garter Snake Species; With GIS Applications

Courtney Tomlin – Biology

Coauthor: Eric Gangloff

Faculty Mentors: Jennifer Gagliardi-Seeley, Claire Hay

Resource partitioning occurs to reduce competition between two similar species. This research is examining habitat partitioning of two sympatric species of garter snakes; *Thamnophis elegans* and *Thamnophis radix*. We hypothesize that when these two species are located in the same geographical area, they will be located in different habitats. After collecting GPS data on Colorado garter snakes over a 3 year time span in a Denver metro location (Commons Park), GIS software was used to analyze the difference in distance from the nearest water source of two common garter snake species. The Western Terrestrial garter snake (*T. elegans*) was found to be statistically significantly closer to a consistently contained stream channel than the Plains garter snake (*T. radix*). This data suggests that sympatric garter snake species exhibit habitat partitioning to reduce competition.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #18)

Cenote and Cave Passage Detection Using Vegetation Analysis of High Resolution Multispectral Satellite Imagery

Wesley Underwood – Land Use

Faculty Mentor: Stella Todd

Cenotes and their associated cave systems represent a valuable geological, cultural and natural resource asset in Yucatan Mexico. The recent accelerated urban growth rate has the potential of endangering this asset due to the hidden nature of these underground systems. Locating this subterranean network of fresh water passages is time intensive and contains inherent inaccuracies due to manual underwater surveying methods. Using high resolution multispectral satellite imagery, land cover classification and vegetation analysis methods to identify characteristics associated with cenotes should prove to be an efficient method of identifying and documenting underground assets. This analysis employed high resolution WorldView2 satellite imagery to create a land cover classification of vegetation and non-vegetation signatures. Multiple vegetation health indices were created to rank the vegetation health and stress indicators primarily associated with access to water. A composite vegetation health-stress classification was created from these indices, and evaluated against a dataset of known cave passages. Buffered analysis zones were created surrounding the cave passages, for statistical analysis of the vegetation health-stress classification. Results found a statistically significant correlation between the known passages and the presence of high-health vegetation classes. Analysis of the zonal statistics revealed that the presence of high-health vegetation decreases with distance from the cave passage zone. Creation of a predictive model was

inconclusive, and did not provide an intuitive visual prediction of cave passage locations. The composite vegetation health-stress methodology employed for this analysis demonstrated that vegetation exhibiting high health characteristics correlated with the proximity to known cave passages. Vegetation exhibiting signs of increased biomass and water content have been successfully correlated with their proximity to known flooded cave passages. Further refinement of the methodology employed in this study may provide a predictive model to guide further cave exploration efforts, and protect endangered water resources.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #24)

In-Stream Erosion Pin Study

Jeremiah Unger – Environmental Science

Faculty Mentor: Thomas Davinroy

The study of urban hydrology is a mature science and the degradation of natural channels is well documented. Few inexpensive tools exist to measure the amount of erosion along non reinforced stream bank channels at particular bank cuts. A two year study to measure the effectiveness of Horizontal Erosion pins was conducted along Cottonwood Creek and Big Dry Creek in the Southeast Metro Stormwater Authority (SEMSWA) district in Centennial, Colorado Information was obtained from such a study providing quantitative data to help policy makers determine when to repair bank cuts along urban streams.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #25)

Broncos Parkway Water Quality Swale Restoration Study

Jeremiah Unger – Environmental Science

Coauthor: Jeremy Eckenroth

Faculty Mentor: Sara Schliemann

The Broncos parkway water quality swale is located in Unincorporated Arapahoe County within the Southeast Metro Stormwater Authority Service area. The water quality swale (swale) was installed to treat surface run-off from Broncos Parkway before discharge to Lonetree Creek. This study was conducted to determine the most effective native vegetation establishment along the swale slopes with a combination of treatment methods such as: soil treatments, erosion control treatments, and planting techniques along the slopes of this swale. Sampling technique included both plant count (quantitative) and percent ground cover (qualitative). Indicating a simple native seed mix with no erosion control measures allows for the most vigorous growth. The site has no irrigation and limited access so a sustainable, quickly established and low maintenance solution needs to be found. This study finds that the Further studies may provide more suitable seed mixes or design implementations to advance the area of a native vegetation establishment for post construction of these necessary stormwater treatment systems.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #3)

Heat Transfer Manipulation of Friction Based Vehicle Braking Systems

Lukas Vaznonis – Mechanical Engineering Technology

Coauthor: Adam Thomas, Jason West

Faculty Mentor: Lynne Zhao Bowden

Millions of vehicles perform near or past their mechanical limits every day, especially those of the brake system. Brakes convert the kinetic energy of a moving vehicle into heat by the force of friction. Once enough heat is absorbed, components overheat and fail. The Colorado Department of Transportation found that 29.4% of all large truck crashes involved brake failure. The most common issue is boiling of the hydraulic brake fluid, at which point it becomes compressible and can no longer provide sufficient pressure for the system. The second largest issue is a decrease in friction of the brake pad-rotor interface due to temperature induced surface deformation. The objective is to develop a system in which heat transfer is manipulated away from the hydraulic fluid and brake pad-rotor surfaces. To monitor temperature, thermocouples are utilized on the brake caliper and pad, and an infra-red thermometer is used on the moving brake rotor surface. An accelerometer, hydraulic pressure, and wheel speed sensors are used to calculate the friction coefficient. Insulating spacers composed of Copper, Fiber Glass, and Stainless Steel are built as part of the cooling solution and are used between the brake pad and the fluid holding caliper. Air ducting powered by a high velocity fan is also incorporated to cool the rotor and brake pads. Final testing of the insulating shims shows that temperature is decreased by 41.5% at the caliper pistons during a 1000°F steady state scenario. Computational fluid dynamics testing indicates that the air ducting provides the necessary additional airflow and increases the convective heat transfer at speeds below 40 mph. These results prove that heat transfer can be manipulated with cost effective and easily obtainable materials to achieve an optimum temperature of heat generating devices to extend their life and performance.

(Oral Presentation, Session III, Room 205, 3:30 PM)

Hispanic Discrimination in the U.S. Court System

Juan Vigil – Criminal Justice

Faculty Mentor: Joseph Sandoval

The purpose of this report is to explain how the Sixth and Fourteenth Amendments of the United States Constitution impacted jury trials for minorities, especially Hispanics. Landmark cases, such as *Hernandez v. Texas*, *Strauder v. West Virginia*, *Batson v. Kentucky*, *Swain v. Alabama*, and *Duncan v. Louisiana* have been important cases in which a minority was not tried by a jury of their peers or were indicted by a grand jury that did not include a member of the jury who was a minority. This report will also include local cases, such as *The People of the State of Colorado v. John Cerrone* and *The People of the State of Colorado v. Lawrence Goetz*. The Cerrone and Goetz case brings the issue of race and economic discrimination. All of these cases recognize the fact that minority defendants were not afforded the same rights that everyone else is entitled to. This report will identify the issues with discrimination in the judicial system as well as how it has changed the way for all minority groups to be represented in any criminal court case.

(Oral Presentation, Session II, Room 200, 11:15 AM)

Longitudinal Water Quality Sampling of Bear Creek During Winter 2013-2014

David Watson – Biology

Coauthors: Denise Wilkins, Armando Lopez

Faculty Mentor: Rebecca Ferrell

Bear Creek is an urban watershed that falls under the responsibility of several different municipalities in the Denver area. In a previous study undertaken by the non-governmental organization Groundwork Denver and the U.S. Environmental Protection Agency (EPA), sampling sites were identified and data collected throughout the summer of 2013 to analyze water quality in the creek. Our study, also in cooperation with Groundwork Denver, uses the same sampling sites as the EPA study; we began in September 2013 and continued sampling every two weeks throughout the winter months. Water was analyzed for coliform bacteria, the specific fecal indicator organism *Escherichia coli*, dissolved oxygen, flow rate, temperature, pH, optical density and specific gravity. The EPA study made the assumption that fecal contamination in Bear Creek was seasonal, occurring only in the warmer months, but the results of our winter research indicate that high *E. coli* levels are also found in winter, occasionally exceeding the Colorado Department of Public Health (CDPH) limits for recreational waters. Our research group is involved in ongoing efforts to identify the sources of fecal contamination in Bear Creek with the goal of encouraging remediation and restoring water quality.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #12)

Some Chemical Applications of Group Theory

Jacob Wiens – Chemistry

Faculty Mentors: Michael Jacobs, Mona Mocanaru

Chemists are concerned with understanding the nature of chemicals. In order to make meaningful conjecture with our experiments, we must have a vast theoretical framework to rely on. At what point can we stop expanding our theoretical understanding and be satisfied that there is little more that could be a better use of our time? At some point investigations into symmetry will satisfy any inclination to further investigate what might lie within the possible realm of experimentation. It does not say what lies in the field, so there is still all of science to be done; however, it does shed light on a lot of what cannot possibly exist. With symmetry things take shape and lose the ability to traverse by magic. Molecules organize themselves in known patterns with a cyclic extent of motion and a calculable tendency for their orientations. Furthermore, suppose two of these orientations, by principle these orientations must differ in energy. Symmetry can tell us which would be favorable. If you consider two enantiomers and remember the spin of electrons in our universe even these nearly identical isomers have a lower energy state between the two. Group theory, which is the mathematics behind symmetry rectifies many loose ends in molecular orbital theory and expands our understanding with group orbitals. Also symmetry allows us to manipulate the wave function and consider many of its bounds all at once

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #27)

At Home in the Mile High City: Student Digital Ethnographies

Samuel Williams – Anthropology

Coauthors: Ginny Phelps, Brian Laster, Teresa Soloman, Krista Balsick, Jessica Cucchi,
Ashley Rottman

Faculty Mentor: Rebecca Forgash

This session showcases the work of students who were involved in the ethnographic research project “At Home in the Mile High City” during fall 2013. The project explores notions of locality and identity embedded in the speech of people living in the Denver Metropolitan Area. Researchers worked with a single participant throughout the semester. Utilizing ethnographic data methods such as Participant Observation, audio recording of naturally occurring speech, photography and life history and other semi-structured interviewing, they gathered qualitative language and cultural data and conducted a preliminary analysis. Additionally, students constructed short digital ethnographies from the photographs they took and audio from the interviews, following the seven steps of Joe Lambert's How to Tell a Digital Story. The session will include the screening of seven digital ethnographies and a discussion of the following four underlying themes: Denver's Physical Beauty, having socioeconomic freedom, establishing a home and a strong sense of community.

(Oral Presentation, Session III, Room 203, 3:00 PM)

The Self-Determination Theory of Motivation: A Review of Academic Literature

Scott Williamson– Psychology

Coauthors: Anastasia Zavilla, Lorne Jones, Gerard Whalum, Aaron Slaughter, Chris
Bruntsch, Shelby Harsh

Faculty Mentor: Morey Kitzman

Motivation is the driving factor behind human behavior and the foundation for quality performance of behaviors. One of the prevalent theories of motivation is the self-determination theory first proposed by Professors Edward L. Deci and Richard M. Ryan (1985). The purpose of this review was to investigate the self-determination theory of motivation and performance, and the implications it has had for sport, performance, and organizational psychology. Multiple scholarly and peer reviewed publications were reviewed, common themes about the implications self-determination theory has had on various professions (particularly in sport and high risk industries) were identified, and mechanisms of self-determination theory were discussed. Self-determination theory focuses on the interplay between extrinsic motives, intrinsic motives, and three needs inherent in human nature. In the literature, these inherent needs are identified as autonomy, competence, and relatedness. The research revealed that self-determination theory facilitates the transition of extrinsic motivators to become more intrinsic through internalization. Reframing or adjusting a task so that it appeals to the three basic needs is the mechanism by which internalization can occur. This has important implications in that it can help individuals alter their source of motivation, which can lead to better performance and improved well-being. This theory has found its foothold in the sport industry but translates to the medical, business, and theatrical fields, all of which require training and focus to perform at a peak level. Literature on self-determination theory shows an overall positive impact on human motivation, performance and well-being, and indicates a vast unfulfilled potential for further application.

(Oral Presentation, Session III, Room 200, 3:45 PM)

Situations Changing Our Conflict Modes

Joshua Q. Woods – Psychology

Faculty Mentor: Lesley Hathorn

While trying to maintain any type of relationship, it is essential to realize the influence of conflict resolution styles. Conflict modes vary as to the level of emphasis put on the relationship verses the priority on completing a goal. The purpose of this study was to see if stress could manipulate a participant's conflict style. Using a video clip to induce stress on MSU Denver college students and the Thomas-Kilmann conflict mode instrument to determine participants preference in modes, it was determined that there were no significant changes in modes after a stressful situation. The results should prompt further research on how to change poor styles of conflict resolution, to a more appropriate style knowing that the mode can remain constant throughout a stressful situation.

(Oral Presentation, Session II, Room 200, 11:30 AM)

Subspecies Identification of Cutthroat Trout Utilizing the Male-specific OmyY1 Region of the Y Chromosome

Josh Woody – Biology

Coauthors: Jaret Newman, Nickolas Nelson

Faculty Mentor: Douglas Petcoff

Accurate subspecies identification is critical, if conservation efforts for the endangered Greenback Cutthroat Trout are to be successful in Colorado. Morphological characteristics are not precise enough to provide reliable identification. Genetic markers obtained from highly conserved regions of the mitochondrial DNA for maternal lineages, and from the Y Chromosome for paternal lineages, allow for more accurate subspecies determination. The OmyY1 region of the Y chromosome has been shown to evolve much more slowly than mitochondrial DNA, making it highly suitable for subspecies identification. Primers have been designed to extract the OmyY1 locus from the nuclear DNA. Within that locus, nested primers are utilized to perform PCR reactions, isolating and amplifying the OmyY1 region (gene) for subsequent sequencing. The sequences of DNA and proteins obtained will be subjected to sequence alignments and comparative analyses, aimed at inferring the molecular evolutionary patterns of genes, genomes, and subspecies as well as phylogenetic histories over time. Relative time estimates will be produced that will provide the facility for determining the ordering and spacing of sequence divergence events in subspecies and gene family trees. The (relative) branch rates produced will also enable this study to determine the statistical distribution of evolutionary rates among subspecies and detect rate differences between subspecies and duplicated gene clades. In these largely allopatrically-evolving subspecies, Single-nucleotide polymorphisms (SNPs) occurring in the Y-haplotype phylogeny will be compared for correspondence with previously determined SNPs from mitochondrial haplotypes and to relationships inferred from protein markers. The reliable and complete analysis of the OmyY1 region of subject fish should prove useful in determining subspecies status, in support of conservation efforts intended to reestablish viable populations of the Greenback Cutthroat Trout to Colorado.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #8)

Identifying Black Spots in Denver

Chelsie Worth– Land Use

Coauthor: Alexandra Gross

Faculty Mentor: Stella Todd

On average, every 14 seconds a motor vehicle crash related injury occurs in the United States. In 2012 alone, 472 people died in crashes along Colorado roadways. In Denver Colorado over 80,000 individual crash records are maintained as data points. With proper analyses, these data points have the potential to yield information about the role of the built environment on roadway behavior. Using an applied approach, this research aims to discover the analysis method most applicable to the particular problem of analyzing and visualizing point data along a constrained one-dimensional network in a GIS. Using best methods, locations (or black spots) where a high number of crashes are observed were derived from the Denver crash dataset. Further, primary data was collected at each identified black spot to determine the involvement of environmental factors in an individual occurrence and suggestions will be made to mitigate those potential factors. Kernel density methods assuming planar surfaces have been used to derive black spots from the Denver crash dataset in five neighborhoods (Civic Center, Five Points, Capitol Hill, North Capitol Hill and the Central Business District). Those black spots will be compared to black spots derived using a K-function method constraining the data to one-dimensional space employing networks created Department of Transportation records. Primary data collection was performed at individual black spots identified using Kernel density methods. Photographs, site drawings and component inventories were gathered. Assessments will be made of the collected findings to determine potential problems and suggest mitigation. Visualization and communication methods will be explored considering the various backgrounds of stakeholders and decision makers who could benefit from meaningful analysis of the vast crash dataset. Future research will incorporate attributes like hit-and-run incidents or time of day, also, automation of analysis methods will be employed considering the frequent addition of new data points.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #26)

School Aged Children's Perception of Nurses

Kimberly Wynn– Nursing

Coauthors: Allyson Fujita, Journi Jones

Faculty Mentor: Alexis Newton

This purpose of this study was to investigate children's perceptions of nurses and what nurse's do. The methodology used was an exploratory ethnographic study utilizing drawings from children in the second and six grades within the Jefferson County school district. Forty-eight children participated in this study. The children were asked to draw a picture and/or write about what a nurse looks like and what a nurse does at his/her job. An analysis of data demonstrated an overarching theme of nurses being regarded in a positive light. Nurses were represented mostly as women with the word "help" used in the majority of written descriptions. Pictures were successful in demonstrating what children see when they hear the word nurse. Knowing how children perceive nurses may assist nurses in building therapeutic relationships with pediatric patients in the community, schools and primary care. This knowledge will better prepare both child and nurse for future encounters.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #15)

Tracking Events Using Networks of Mobile Devices

Christopher Zamora – Physics

Coauthor: Elshaddai Mulugeta, Dorothy-Achiaa Agyemang

Faculty Mentor: Randall Tagg

In an age when widespread communication is the standard, it is easy to get lost in a pool of information. But when the lives of people depend on how quickly and efficiently they have access to information, the need to relay it effectively becomes more real. In instances such as natural disasters, uprisings and local safety, the smallest of tips can make all the difference. Useless information can confuse people but concentrated and personalized accounts save lives. There are three types of people in this world, those who know, those who know and don't share and those who simply do not know. If we can build a hub of data collected from everyone; civilians, officials and the media alike, we can give everyone access to everything they want to know. Through the development of an app and website we are giving people the ease of access to both obtain precedent information as well as submit and report it themselves.

(Poster Presentation, Session II (11:00 – 12:00 PM), Poster #25)

Does Athletic Proficiency in Winter Sports Alter Perception of Mountain Terrain

Anastasia Zavilla – Psychology

Coauthor: Charles Walters

Faculty Mentor: Cynthia Erickson

Perception is the process by which we make sense of the world, but rather than being a static filter our perceptions of reality are dynamic and fluid. Perceptions change with experience and context. Visual perception can be altered by physical states such as fatigue or other bodily changes—this phenomenon has been termed “Embodied Perception.” The purpose of this experiment was to examine the role of motor skill expertise on visual perception. We hypothesized that mastery of a motor skill would alter perception of the environment in which the skill was performed. In order to test the hypothesis that expertise in a motor skill alters perception of visual environment, competent snowboarders were asked to estimate the steepness of a number of slopes at a ski area while wearing their own equipment (snowboards) or rented equipment with which they were unfamiliar (skis). Verbal, visual, and haptic estimates were made at the top and bottom of a number of slopes throughout the ski area, once while participants were wearing their own equipment and again while they were wearing a pair of skis. The majority of the participants estimated the slope of the hill to be steeper when they were wearing equipment with which they were unfamiliar relative to their own equipment. Looking down a steep hill (repeated measures t-test, $p = 0.013$). This is the first demonstration of expertise in a motor skill altering perception of the visual world. The results of this study have implications for the downhill sport and winter sport industries.

(Poster Presentation, Session I (9:30 – 10:30 AM), Poster #12)

Game Theory

Anastasia Zavilla – Psychology

Coauthor: Amanda Ellison

Faculty Mentor: Lesley Hathorn

Cutthroat kitchen is a reality television show where four chefs compete against each other for three rounds. Each round consists of a different dish to be cooked. Several sabotages are auctioned off before the cooking begins. Each chef starts with \$25,000 to use in the auctions. At the end of each round one chef is eliminated for producing the worst dish. The chef who wins three rounds wins the money that chef has remaining. The outcome of the game is uncertain because of the sabotages and skills of the chefs. This study examined game theory models for Cutthroat Kitchen. Game theory takes on a wide range of applications from economics, warfare, and psychology. A game is simply a set of strategies that players or opponents can use to quantitatively describe their choices. Our study looked at non-cooperative dominate strategies a player could use to avoid deleterious outcomes. Participants on the show included 30 men and 22 women. In general, there was no significant difference in the dollar amount won between men or women. Men and women bet similar amounts in the first and third round. However, men bet significantly more aggressively in the second round ($p = .037$), spending twice as much as women to win the auction. Consequently, they also won more auctions in the second round ($p = .024$). The average amount won per episode was \$10, 838. Winners did not bet significantly differently from losers. Consequently, skill appears to be the single most dominant factor in winning.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #2)

Who Hires the Homeless? A Comprehensive Analysis of Hiring Behavior with Locus of Control, Social Dominance Orientation, Empathy and Demographic Factors

Anastasia Zavilla – Psychology

Coauthors: Kelsie Howell, Liliana Alvarez, Eric Klein

Faculty Mentors: Lisa Badanes, Kristen Lyons

Homelessness has become a pervasive social problem worldwide. In the U.S. alone, the poverty rate has increased 3.7% between the years 2000 and 2012 (Bishaw, 2013). Despite the ubiquity of this issue, relatively little research has been conducted to analyze biases toward hiring the job-seeking homeless. Phelan, Link, Moore and Stueve (1997) found that the homeless are viewed even more negatively than domiciled poor. Unfortunately, employers hire applicants who are likeable, attractive, and of similar demographics (Finkelstein, Burke, & Raju, 1995; Raza & Carpenter, 1987). Locus of control (LOC) has been shown to moderate hiring behavior, while empathy and SDO have been shown to moderate orientation toward lower status groups (Batson et al., 1997; Hargrett, 1981; Sidanius & Pratto, 2001). The present study used each of these factors to perform a comprehensive experimental analysis of the social climate surrounding the hiring of homeless job applicants. The aim of this research was to discover which factors might constitute a barrier to upward mobility -- impeding the success of the job-seeking homeless, and which factors could be used to ameliorate the effects of these barriers. Participants evaluated resumes of job applicants who identified as either homeless or unemployed, and completed surveys used to measure multiple personality and demographic factors. Preliminary results indicated that LOC, SDO and empathy were all significant predictors of hiring behavior. Demographics were found to predict both

hiring behavior, and relevant personality factors. The results of this on-going study will be discussed in reference to hiring best practices.

(Oral Presentation, Session II, Room 206, 11:15 AM)

Assessment of Supplement Intake Reported by Common Variable Immunodeficiency Patients Receiving Immunoglobulin Therapy

Sarah Ziherl– Nutrition

Faculty Mentor: Michael Bizeau

Objective: To create a comprehensive list of reported supplements consumed by adult common variable immunodeficiency patients on immunoglobulin therapy. To assess supplement trends, indicators of effectiveness, and available published data. To add to the body of knowledge on the nutritional needs of adult CVID patients on IG therapy. **Participants:** Nationwide pool of adult CVID patients receiving IG therapy, enrolled in the IDEaL patient registry program (n=256). **Methods:** Study data, which included patient ICD-9 code, age, medication profile, and monthly infection rate, were provided by the IDEaL Patient Registry. Published data, pulled from Pubmed and Medline, provided additional information in this field of study. **Results:** 66% of patients reported consuming sixty various supplements. 25% reported using a single supplement, 18% reported using two supplements, and 6% reported three supplements. 45% reported using Vitamin D and 31% reported using calcium. Supplement consuming patients reported a 23% monthly infection rate, while non-supplement consuming patients reported a 22% monthly infection rate. Number of supplements consumed compared to monthly infection rate had a 0.02 correlation coefficient. Published research indicated consistent Vitamin A deficiency in CVID patients. **Conclusions:** Among CVID patients on IG therapy, there does not appear to be a relationship between supplementation and monthly infection rate. While published research indicated a consistent Vitamin A deficiency, this supplement was not consumed in IDEaL patients. It is evident medical care providers should be made aware of overwhelming Vitamin A deficiencies in this population to best treat the nutritional needs of their patients.

(Poster Presentation, Session III (3:15 – 4:15 PM) Poster #14)

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